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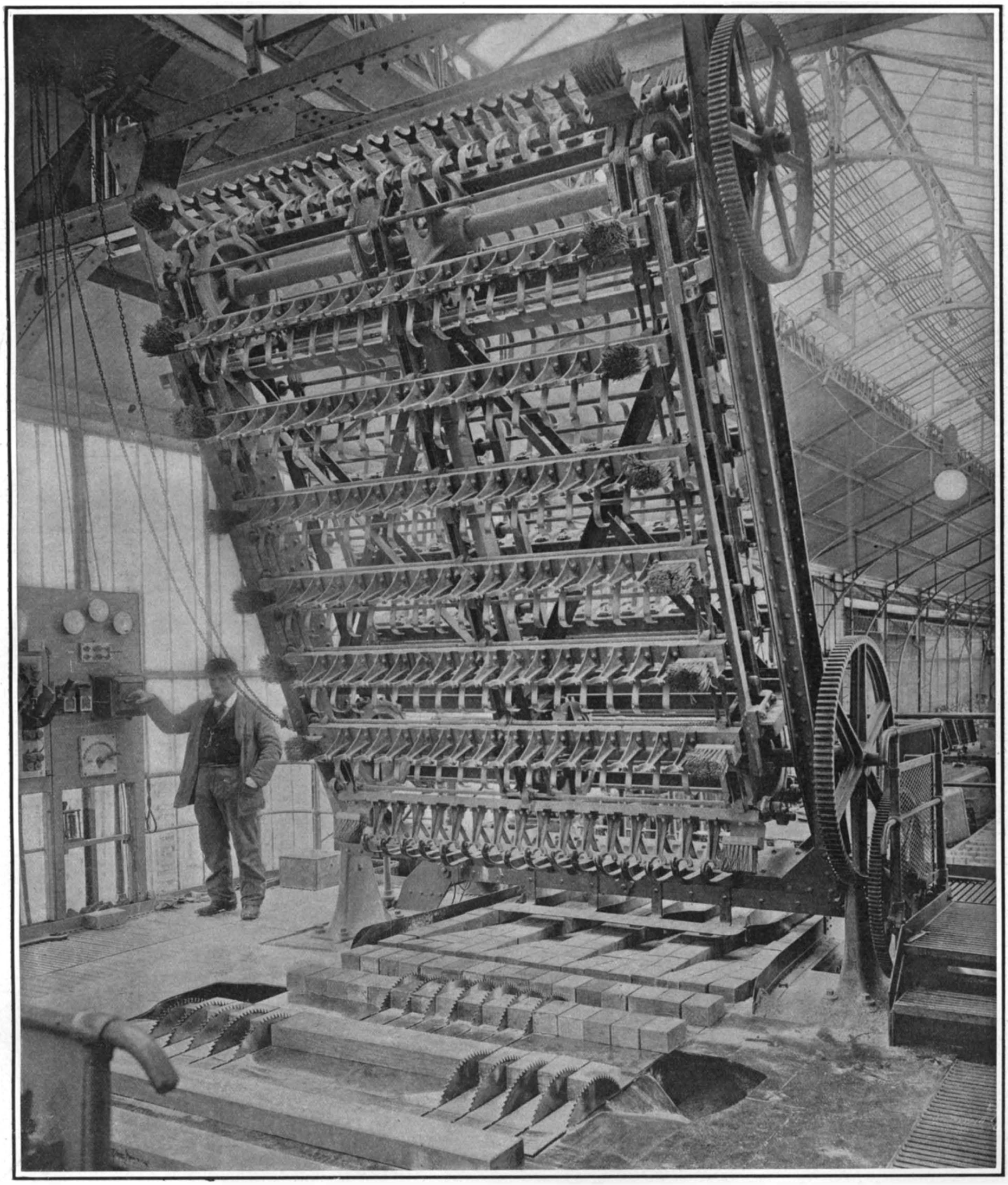
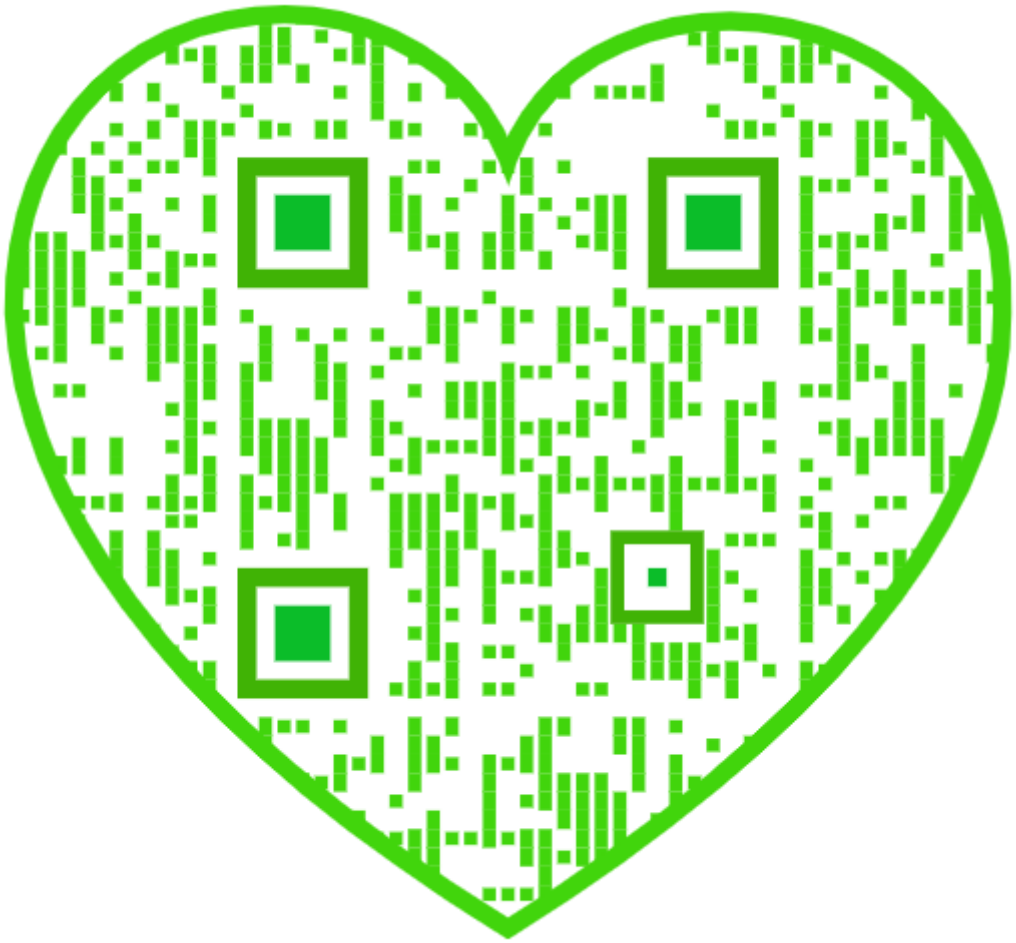


The Sawing Table. The Horizontal Bed Has Been Lifted to Show the Arrangement of the Circular Saws.

A MACHINE THAT SAWS 240,000 WOODEN PAVING BLOCKS IN A DAY.—[See page 273.]



SCIENTIFIC AMERICAN

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NEW YORK, SATURDAY, APRIL 18, 1908.

The Editor is always glad to receive for examination illustrated articles on subjects of timely interest. If the photographs are *sharp*, the articles *short*, and the facts *authentic*, the contributions will receive special attention. Accepted articles will be paid for at regular space rates.

HEALTHY CONDITIONS AT PANAMA IN 1907.

The people of the United States have abundant reason to be satisfied with the tidings which have been reaching them during the past few months as to conditions at the Isthmus of Panama. Following close upon the recent announcement that over 3,000,000 cubic yards of material were excavated last month, comes the last report of Col. Gorgas, Chief Sanitary Officer, and its statement of the highly satisfactory sanitary conditions among both the employees and the general population.

During the past year 71,000 people came to the Isthmus and 44,000 left it, which gave an increase in population of 27,000. The total population of the Canal Zone last year was 102,000, and during the year there was an average of 39,343 employed on the canal in one capacity or another. Of these employees, 10,709 were whites and 28,634 were negroes. Among the white employees the death rate was 16.71 per thousand, as against a rate in 1906 of 16.27 per thousand. Among the negroes the death rate was 33.28 per thousand, as against 49.01 per thousand in 1906. The death rate among the whole number of employees, irrespective of color, was 28.77 per thousand in 1907, as against 41.24 per thousand in 1906; that is to say, the improved health conditions last year over those of 1906 resulted in the saving of the lives of 507 men of the laboring force. A similar improvement has occurred in the health of the total population, both employees and non-employees. In 1906 the death rate was 49.10 per thousand, and this was reduced last year to 33.63 per thousand, which represents the saving of 1,632 lives in a total population of 102,000.

That the health conditions are comparable with those which obtain in this country is shown by the fact that among the 4,300 white American employees there were, during the year, 42 deaths, 29 of which were due to disease. This gives a death rate from disease of 6.74 per thousand, which is about the same as would occur among a similar body of men in any part of the United States where health conditions were normal. The death rate among the women and children of the families of these men was, moreover, about the same as would occur among the same class of people in the United States. It is evident from these statistics that careful hygiene and systematic sanitation have stripped the once greatly-dreaded Isthmus of Panama of its terrors, and rendered it perfectly safe for residence and occupation.

SAFETY OF THE BROOKLYN BRIDGE.

The recent opening of the new service of six-car trains across the Brooklyn Bridge has raised, once more, the question as to whether this structure is not being overloaded. It will be remembered that, when the surface trolley cars were admitted to the bridge, there was the same discussion as to the ability of the structure to carry the increased load. With a view to quieting any anxiety which may have been raised in the public mind on this subject, Chairman Willcox of the Public Service Commission was furnished with the results of a careful investigation of present conditions made by the Bridge Department engineers, which shows not only that the bridge is capable of carrying with a proper margin of safety its present load, but that structurally it is in a better condition than ever before.

This rather surprising result is due largely to the fact that, after the original bridge plans had been completed and the bridge had progressed to a point where it was ready for the stringing of the cables, it was decided to substitute steel wire for the iron wire which it was originally intended to use; and, with wise provision for future increases of load, it was decided to maintain the same diameter as was chosen for the iron cable, and thus secure the great increase of strength resulting from the substitution of steel. The advantage of this change has made itself felt throughout all the history of the bridge; for in the subsequent investigations of its strength, which became necessary whenever increased loading was proposed, the main cables have always been found to be amply strong to take care of the added weights. Similarly, the vertical suspender cables and their connections to the main cable have proved able to meet the new conditions.

The weakest part of the bridge has always been the floor system, with its shallow trusses and light latticed floor beams. The stiffening trusses, whose duty it is to prevent undulation of the roadway and preserve it in true line under uneven loading, are altogether too light for their work; and at various times during the past ten years, when there has been an unfavorable conjunction of circumstances, such as a heavy concentration of load due to a breakdown on the roadway or the cable tracks, during a period of extremely hot weather, the trusses have given way, either by the buckling of the bottom chords or by the breaking of the diagonals. There was also a serious failure a few years ago of several of the vertical suspenders near the expansion joint at the center of the main span—an accident, by the way, which came within an ace of causing the whole of the suspended roadway to strip from the hangers and drop bodily into the East River. Both of these accidents, however, were quite preventable, and their occurrence was due to lack of proper supervision of the traffic and of proper maintenance and repairs of the bridge itself. Following immediately upon the alarm caused by the breaking away of the roadway, the maintenance of the bridge was placed in the hands of qualified engineers, and strict regulations were laid down for the proper spacing of the traffic and the prevention of congestion of the trains and vehicles.

It must be remembered that the Brooklyn Bridge, designed as it was over a quarter of a century ago, necessarily embodies some of the crudities of design and construction, especially in the details, which characterized the earlier stages of the development of American bridge building. But during the past few years the whole structure has been carefully gone over, and, as far as possible, the poorly-designed parts and fittings have been removed and better work inserted, the details being in certain instances also strengthened. Consequently, when the engineers, especially appointed to the task, made their recent investigation of the bridge they were able to report that, so far from its being in poor shape, it was actually, in spite of the increased loads, in as good, if not better condition, than ever before in its history. Moreover, it is intended, shortly, to undertake a thorough reconstruction of the floor system, during which the present roadway will be replaced by an entirely new structure, with deep and stiff trusses, and solid plate floor beams and stringers. The increased load of the new floor will be taken care of by supplementary cables, carried upon independent steel towers built into the present masonry towers.

DOUBLE-DECK SUBWAY EXPRESS STATIONS.

One of the most important suggestions made by Bion J. Arnold for increasing the traffic capacity of the Subway is, that at the express stations all four tracks should be given up to express trains, and that the local trains should pass through the stations on an upper deck built above the present platforms. The change would not be so costly as might be supposed; for the height from rail to roof of the express stations, with one possible exception, is sufficient to allow for the construction of a second story. The suggested change is based upon the now well-recognized fact that the carrying capacity of the Subway is determined by the number of trains which can be passed through the express stations in a given time, and that the large amount of time at present consumed in unloading and loading passengers is a serious handicap upon the efficiency of the whole system. As matters now stand, it frequently occurs that a following express train has to slow down, or even come to a full stop, while the train ahead of it is loading and pulling clear of the station. It is Mr. Arnold's idea to prevent this delay by putting in a switch from the express to the local tracks, by which the express trains can be switched alternately to one or the other side of the present platform, an arrangement which would permit two express trains to be unloading onto the same platform at the same time. The local tracks would commence to ascend on an even grade, some distance back of the switches, and the local trains would pass through the stations without any interference whatever with the expresses. The one drawback to the proposed arrangement would be that passengers transferring from local to express trains, or *vice versa*, would have to pass down or up a stairway, as the case might be. This, however, would be more than offset by the fact that the two-deck plan would result in a separation of the local and express passengers, and greatly relieve the present interference and crowding. If the change were made, it is estimated that the carrying capacity of the Subway would be increased fifty per cent.

HEROIC MEASURES IN HUDSON TUNNEL CONSTRUCTION.

It is seldom that a great engineering work involving untried problems of a complicated and serious character has been carried through so quietly as was the final successful construction of the Hudson River tunnel. One of the engineers has recently described some very puzzling situations which arose in connection with the various "blowouts" that occurred from time to time. One of the most troublesome of these occurred while the tunnel was being driven across the reef of rock which was encountered near the Manhattan shore. As the tunnel reached the easterly end of the reef, the roof approached so near to the bed of the river, that the clay became practically fluid, and caused a great deal of trouble by entering the pockets of the shield, and preventing the men from passing underneath the projecting apron in front of the shield to drill out the rock. In the endeavor to stiffen the overlying bed of clay, scowload after scowload of material was dumped into the river. In spite of the artificial bed thus formed, the clay was still so fluid that it could not be held back by the air pressure. It was at this crisis that the resourcefulness which is a distinguishing characteristic of every successful engineer was brought into play. It was decided to stiffen the clay by directing sufficient heat against the exposed material in front of the shield to actually turn it into brick *in situ*, and so give it sufficient rigidity to stand up in place. To this end a series of blowpipe flames, fed by two tanks of kerosene, were directed against the exposed material, until it had been so thoroughly baked, that it was able to hold its position until the men had drilled out the reef ready for blasting. The turning of the clay into brick took about eight hours, and during this time, streams of water were directed on the shield, to prevent it from being injured by the fierce heat of the blowpipes.

Another case of emergency work occurred in a blowout which happened on the Hoboken side, when the heading was lost, and the space between the shield and the lock was filled up solidly with mud. With a view to closing the opening by which the mud was entering the shield, two thicknesses of one of the heavy mainsails of a former "America" cup defender were stitched together and spread out over a barge, with weights secured around the edges. The barge was then withdrawn, allowing the mainsail to drop to the bed of the river, half of the sail lying above the shield, and the other half extending above the mud toward the center of the river. One of the valves in the air lock was then opened, and, under the pressure of the inflowing mud, the easterly half of the mainsail was drawn down, across and into the open doorway in the shield. A slight air pressure was then introduced back of the shield, relieving the strain on the canvas, and men were able to get once more into the tunnel and dig out the mud which had flowed in. The poet has reminded us that "Imperial Cæsar, dead and turned to clay, might stop a hole to keep the wind away"; and scarcely less anomalous, surely, is this latter-day use of the cream-tinted mainsail of a cup defender to plug a mudhole under the Hudson River.

SAFETY DEVICES ON RAILROADS.

A comparison of the number of accidents occurring on the railroads of the United States with those on railways in other countries proved so striking that Congress directed the Interstate Commerce Commission to prepare a report upon the use of safety devices on railroads. So far as the Commissioners have investigated the subject, they find that accidents are due chiefly to failure on the part of signalmen, generally telegraph operators. Of 160 Class A collisions that occurred between July 1, 1904, and July 1, 1906, thirteen happened under the telegraph block system, and all, in the opinion of the Commissioners, were due to the telegraph operators and not to the engine drivers. In the same period of two years, seven Class A collisions took place on lines using the automatic block system, in which there are no telegraph operators. These were due to the negligence or misbehavior of engine drivers. From these facts the inference is drawn that the defect in the automatic block system is that the telegraph operator is not there to caution the engine driver. The absence of the operator exposes the engine driver to the danger of failing to observe the signal.

In the opinion of the Commissioners, the telegraph operator is the chief cause of the failure of the block system to prevent accidents. The main reason for his failure is that his hours of labor are too long, so that he falls asleep or cannot keep in an alert condition. Operators have been kept at work for twelve hours a day. The La Follette law, regulating the

hours of work of railroad employees, will remedy this, one of its provisions being that no telegraph operators who are concerned in signaling trains or issuing train orders shall be on duty for more than nine hours a day.

Yet, notwithstanding some failures, the block system is regarded by the Commissioners as unquestionably the best means of preventing collisions. Expert railroad men and the general public agree in demanding its use. The best railroads employ the system widely, and are extending its use; the signal engineers are striving continually to bring it to a state of perfection. The manager of one of the most important systems of railroad in the United States asserts positively that the installation of automatic signals of the most modern kind has been one of the best investments the company has ever made in any of its departments. Yet the motives that induce railroads to make the added outlay of several hundred dollars per mile to introduce the block system are various. Some introduce it because many collisions of freight trains, causing considerable loss and suggesting the probability of greater loss, have occurred. Other companies do so because they have had to pay a large sum of money as damages for injuries caused by a collision. Others, again, know that passengers prefer to travel over a line safeguarded by the block system. Some managers wish to gain as high a reputation for safety as possible, while others are driven to it by the fact of competing lines adopting it.

Before railroad accidents are reduced to a minimum, automatic stops as well as automatic signals must be adopted. Automatic stops are already in use on the express tracks of the New York city subway and on the Boston elevated railroad. The Commissioners say that collisions on railroads could be reduced to an exceedingly small number by the efficient use of block signals and of other well-known and approved safeguards; and that an automatic stop would abolish the small percentage of collisions remaining.

THE AVIATION SECTION OF THE AERO CLUB OF AMERICA.

At a meeting of the Aero Club of America on April 6, the formation of an aviation section was decided upon. A committee of five was appointed for the purpose of organizing this section, and of providing rules and by-laws for its government. This committee immediately set to work to draft suitable rules, and to draw up plans for aiding in every possible manner the development of the heavier-than-air flying machine in America. The new section, while it forms part of the Aero Club, is devoted entirely to the development of heavier-than-air machines. A person can join this section, irrespective of whether he is a member of the Aero Club or not. The dues, it is expected, will be $10. Among the advantages to be had from membership in the new section will be the use of a suitable experimental field for testing machines, which field it is expected will be located in the vicinity of New York. Sheds will be provided for the housing of machines, and a machine shop will be at hand.

Facilities will also be provided, whereby members can make experiments in gliding flight. There will be one or more gliding machines and gasoline motors owned by the section, and members will have the privilege of experimenting with these, and of applying the motor to the glider and making longer flights after they have mastered the simple aeroplane. Other advantages to be had from a membership in this section will be a weekly bulletin of events in the aeronautic world and a subscription to the magazine "Aeronautics." Members will also have the advice and assistance of technical men interested in the new science.

The aviation committee requests donations from all wealthy people who are interested in the progress of aerial navigation, for it is only by the offering of a number of large cash prizes to be competed for, that rapid progress will be made in this country as has been done abroad.

NEW YORK'S AUTOMOBILE CARNIVAL AND HILL CLIMB.

Last week there was held in New York city a special automobile carnival, the two chief events of which were the parade on the evening of April 7 and the hill climb at Fort George hill on the afternoon of April 9. In the former of these events over 1,000 machines participated. The parade consisted of several divisions, one of the most interesting of which was that of historic cars. Mr. Haynes brought from the Smithsonian Institution at Washington his first 1893 machine, and drove it in the procession. Other early Haynes machines, as well as similar early cars of the Autocar and Ford companies, the Gasmobile, and the Panhard were among the historic cars in line. The first division, besides automobile chariots carrying the king and queen of the carnival, was made up of historic and recent racing automobiles. The second division consisted of new 1908 machines, and gave a very good idea of the appearance of the most recent models. The third division consisted of decorated machines of various makes. Miniature electric lights were used largely in the decorations, as well as flags, bunting, Japanese lanterns, etc. The fourth division was the one of the greatest practical interest, since it consisted of all kinds of commercial vehicles propelled by gasoline or electricity. The display of Hewitt trucks was one of the most striking, since all of these vehicles were brilliantly illuminated with electric lights placed along the sides near the bottom. An extremely powerful electric searchlight was one of the interesting novelties. The parade was so extensive that it required about an hour to pass a given point, although the machines traveled at a fairly rapid pace. It was the greatest demonstration that has ever been made of the progress of the automobile industry.

The hill-climbing contest on Fort George hill was another interesting feature of the carnival. This hill is 1,900 feet long, and has an average elevation of 11 per cent. There is a fairly sharp S turn about half way up the hill, and the pavement is of Belgian block. On account of elevated pillars at the bottom of the hill, where the Subway crosses the road, the starts were all made from a standstill, but even with this handicap a record of 36 seconds was made by an Apperson gasoline machine, as against 28 4/5 seconds made by a 6-cylinder Stearns last year, when a flying start was allowed. The new record corresponds to a speed of 35.98 miles an hour. The fastest time, however, was made by a special pointed White steam racer, which traversed the incline in 32 1/5 seconds, or at a speed of 40.23 miles an hour. A Babcock electric runabout made the climb in 1 minute and 24 seconds, or at the rate of 19.91 miles an hour. Besides these chief records, new records were made by a large number of other gasoline cars, which were classified according to price. The hill climb was a decided success, and showed in a striking manner the improvement which has been made in machines.

FACTS ABOUT THE USE OF THE AIR BRAKE.

BY L. F. WILSON.

During the period of slippery rails a few words as to the methods of stopping heavy trains under headway might be of interest to the public.

After a study of air-brake mechanism in connection with the laws of friction, many facts which are surprising to the layman have been recorded by engineers. It is commonly supposed by the public that when a train is stopped by the emergency brakes, the wheels are locked and the train slides. Such is too often the case, but the idea is distinctly wrong. Since the bearing surface of the brake shoe against the wheel is much greater than that between the wheel and the rail, it is not hard to set the brake so forcibly that the wheel is locked.

By numerous experiments it has been determined that there are two distinct classes of friction between steel surfaces. These classes are called friction of motion and friction of rest. When the brake is set properly the friction between the shoe and the wheel is friction of motion, while that between the wheel and the rail is friction of rest, as any point on the rim of the wheel is longitudinally stationary with respect to a point on the rail. Now the coefficient of friction of rest is considerably greater than that of friction of motion. For this reason, if conditions are reversed and the wheel is locked, the train will be stopped only in a distance which will be greater in proportion to the difference between the coefficients of moving and stationary friction. This same theory applies when the engineer of the steam train reverses his engine, and gives it steam enough to slide the wheels backward. It also applies, when, in starting a heavy train, he admits so much steam to the cylinders that the wheels slip. In this latter case, every engineer knows that he must immediately "shut off," and start over again more carefully.

There is another very good reason why the wheels of an electric or steam train must never be locked, and that is the fact that a very small amount of sliding will cause a flat spot to develop on each wheel, which will quickly place it out of commission.

When George Westinghouse was perfecting his automatic system of the air brake, several railway companies rendered great aid in testing out each of these theories by experiment. Heavy and light trains running at high speed were stopped by both methods. The results were that each theory was borne out in full.

When we see an elevated train come whirling into a station with all wheels sliding, we know at once that the motorman has either not been properly instructed or else he has not the judgment which tells him just how hard he can set the brakes without locking the wheels.

SECOND EXHIBITION OF SAFETY DEVICES.

The second Exhibition of Safety Devices was opened on April 11 at the exhibition hall of the American Museum of Safety Devices, 231 West 39th Street, New York. It is proposed to keep the exhibition open for several weeks. The installation has required the services of experts. Nothing was allowed to be exhibited until it was passed upon by a competent jury. All readers of the SCIENTIFIC AMERICAN are invited to attend, and it is hoped that the jury for the SCIENTIFIC AMERICAN medal may decide that some device in transportation is meritorious enough to warrant the awarding of the medal.

THE CURRENT SUPPLEMENT.

The opening article of the current SUPPLEMENT, No. 1685, discusses the Marseilles Concrete Dam. The article describes very clearly and very succinctly the project of damming up part of the waters at the southern end of Lake Michigan, so that the mills at Marseilles may not have to suspend operations before the coming of the drainage water. D. T. Randall points out in an article on the fireman at the furnace how necessary good stoking is in a power plant. There is probably no trouble in the gas engine which is so difficult to locate as a bad and persistent "knocking." The causes of knocking and their remedy are discussed. Photo-electric fatigue is considered in an article that contains much new and interesting information. The fifteenth installment of Prof. Watson's admirable treatise on the elements of electrical engineering is published. The subject discussed is alternating current motors. Dr. Theodor Koller contributes an article of technological value on the utilization of paper and pulp mill wastes. Prof. Theodore Schloesing of the Paris University contributes an excellent article on the fixation of atmospheric nitrogen, in which he discusses the new fertilizers. Our many readers who were interested in the article on the Edison concrete house published some time ago in these columns will, no doubt, welcome the publication of a long and thorough discussion of this new venture of Mr. Edison's. Mr. E. S. Larned gives the conclusions of engineers concerning the practicability of the project, and sets forth the purpose of the inventor. Full details are given. An excellent article is that on snakes and reptiles. F. M. Feldhaus writes on the seven wonders of the ancient world. Prof. Percival Lowell replies to his critics in an article entitled "The Habitability of Mars."

SCIENCE NOTES.

De Boekhont and De Vries recently described the spontaneous heating of hay as a purely chemical process. Miehe, on the contrary, regards it as a physiological phenomenon. For the purpose of studying its causes Miehe constructed an apparatus in which small quantities of hay could be sterilized and inoculated with germs at any desired instant. In this way he proved that sterilized hay never undergoes spontaneous heating, but that an elevation of temperature soon occurs in sterilized hay that has been sprinkled with water contaminated with ordinary hay or with earth. The organisms which Miehe finds most abundantly in hay are *Bacillus coli*, *Oidium lactis*, *Bacillus calfactor*, and *Aspergillus fumigatus*. The elevation of temperature is caused chiefly by *Bacillus coli* and *Oidium lactis* up to 50 deg. C. (122 deg. F.). Beyond this point *Bacillus calfactor*, which attains its maximum vitality at 60 deg. C. (140 deg. F.) comes into action. A curious fact discovered by Miehe is the complete sterility of hay extracted from the interior of a large, heated stack. This indicates that the microbes are killed by long exposure to heat and that hay sterilizes itself in the very process of spontaneous heating—a fact of great practical importance. Sterile hay is a far more wholesome fodder than hay which contains microbes, of which several species and especially *Bacillus coli* cause diseases of the alimentary tract, while the molds, *Mucor* and *Aspergillus*, are distinctly poisonous.

An inscription is now placed upon the tomb of Christopher Columbus at Seville, where his remains were transported from Havana in 1898 after the Cuban war, and this inscription has raised numerous objections from Spanish-American visitors who pass through Seville. It reads thus: "When ungrateful America separated from the mother country, Seville received his remains." The term of course applies to Spanish-America in this case. The municipal council of Seville has lately made a request to the Duke of Veragua, the representative of the family of Columbus, in order to obtain his consent to have the inscription changed, and there seems to be no doubt that this will be granted. After the death of Columbus, his remains were not by any means left in repose, but were removed many times from one place to another. His expressed wish was to be buried at San Domingo in the island of Hayti, this being one of the first localities which he reached in his expeditions. In fact, he was buried at first at Valladolid, where he died in 1506. Then in 1509 his remains were transferred to Seville, and it was only in 1540 that his last wish was carried out, when the remains were transported to San Domingo. When this part of the island became a French possession in 1796, the remains were brought to Havana, and they were kept there until recently. Upon the declaration of the independence of Cuba, a new removal was decided upon, leading to the erection of the present tomb at Seville.

THE LATEST DEVELOPMENT IN BRITISH RAILWAY LOCOMOTIVE DESIGN.

BY F. C. COLEMAN.

For the operation of their several long-distance non-stop services, which include daily runs between London and Plymouth, 225¾ miles in 4 hours 7 minutes; London and Exeter (four runs daily) 173¾ miles in 3 hours; and London and Bristol, 118½ miles in the even 2 hours, the Great Western Railway Company have recently constructed at their Swindon works a large locomotive of the "Pacific" type. This locomotive is unique, inasmuch as it is the first locomotive having this wheel arrangement to be designed for any British railway and is moreover by far and away the heaviest and most powerful railway engine ever built in Great Britain. This locomotive, which has been christened "The Great Bear," is a development of the "Star" class of six-wheeled coupled bogie locomotives, several of which have during the past few years been built at the Great Western Railway Company's works at Swindon, having the same cylinder, driving wheel, valve and valve gear arrangements. By the adoption of the pair of trailing wheels, it has been possible however to obtain in the "Pacific" engine a greatly increased size of firebox and to lengthen the boiler very considerably, as will be seen by a reference to the accompanying photograph and dimensioned diagram. The engine has coupled wheels 6 feet 8½ inches, bogie wheels 3 feet 2 inches, and trailing wheels 3 feet 8 inches in diameter. The leading coupled wheels are directly driven by a pair of inside cylinders set in advance of the bogie center, with connecting rods acting on the crank axle, while a second pair of cylinders outside the frames to the rear of the bogie center drive the middle coupled wheels. Steam distribution is by means of piston valves to all cylinders, the four valves being actuated by two inside valve gears of the Walschaert type, modified to meet the special conditions of the Great Western Railway service, and having inside and outside valve spindles on each side connected by a cross lever with two arms fulcrumed near the center on the main frame of the engine. This arrangement of valve mechanism is claimed to give eminently satisfactory results, and such as to completely overcome the objection entertained in some quarters to operating four valves by only two valve gears. The four cylinders, 15 inches diameter and 26 inches stroke, are supplied by steam superheated on the Swindon system. The coupled wheelbase is 14 feet, and the total engine wheelbase 34 feet 6 inches. The boiler is of somewhat unusual size for British practice, the barrel having a length of 23 feet and an outside diameter of 6 feet, these figures being 8 feet 2 inches and 6 inches respectively in excess of the boiler measurements of the Great Western Railway Company's 4—6—0 type of engine previously mentioned. The total heating surface is no less than 3,400.81 square feet, to which the superheater tubes contribute 545 square feet, the fire tubes 2,673.45 square feet, the arched tubes 24.22 square feet, and the fire box the remaining 158.14 square feet. The superheater tubes 84 in number are each 21 feet 4 inches in length and 1⅝ inches in diameter. Of the 162 fire tubes, all of which are 22 feet 7 inches in length, 141 have a diameter of 2½ inches, and the remaining 21 a diameter of 4¾ inches. In addition there are four arched tubes, each 7 feet 8½ inches in length and 3⅛ inches in diameter. The area of the fire grate is 41.79 square feet. The working pressure of the boiler is 225 pounds, and the tractive effort 29,430 pounds. In working order the engine (exclusive of tender) weighs 97 tons 5 hundredweight, and the tender—carried on two four-wheeled bogies, a further innovation in Great Western practice—weighs in working order an additional 45 tons 15 hundredweight, giving the locomotive an aggregate weight on metals of no less than 143 tons. The total length over buffers is 71 feet 2¼ inches. For some years the heaviest locomotives in Great Britain have been the six-wheeled coupled bogie engines built by the Caledonian Railway Company for working the heavy Anglo-Scottish West Coast express services, as between Carlisle and Glasgow, on which section of 102¼ miles of track is to be encountered the famous climb over the Beattock Summit. Of these Scottish-built engines, the "Cardean," weighing 130 tons, has previously held the British record. This engine, exclusive of its tender, weighs 73 tons, or 24 tons 5 hundredweight less, but its tender, which, unlike that of the Great Western locomotive, is not fitted with the pick-up water apparatus and is consequently of abnormal dimensions, weighs 11 tons 5 hundredweight more than the tender of "The Great Bear."

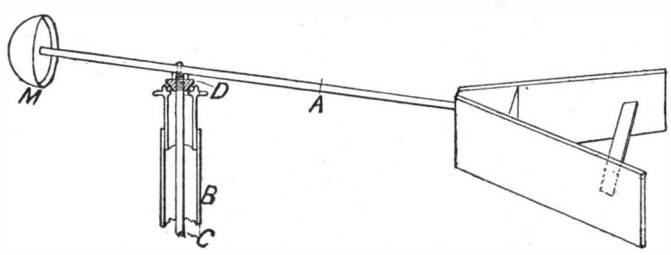


Fig. 1.—Details of the Vane.

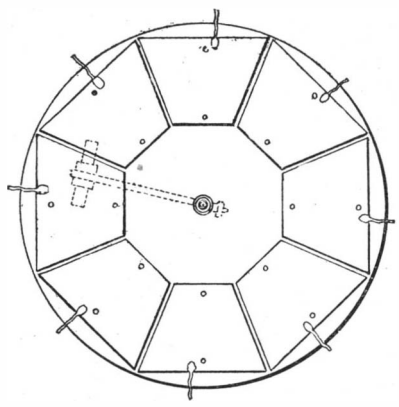


Fig. 2.—Contact Table.

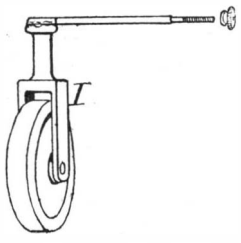


Fig. 3—Contact Roller.

Fig. 5.—The Indicator.

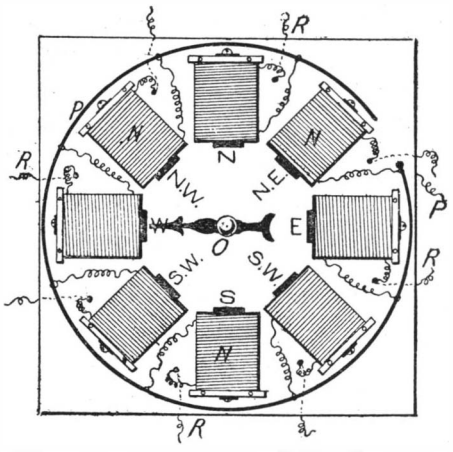


Fig. 4.—Arrangement of the Magnets.

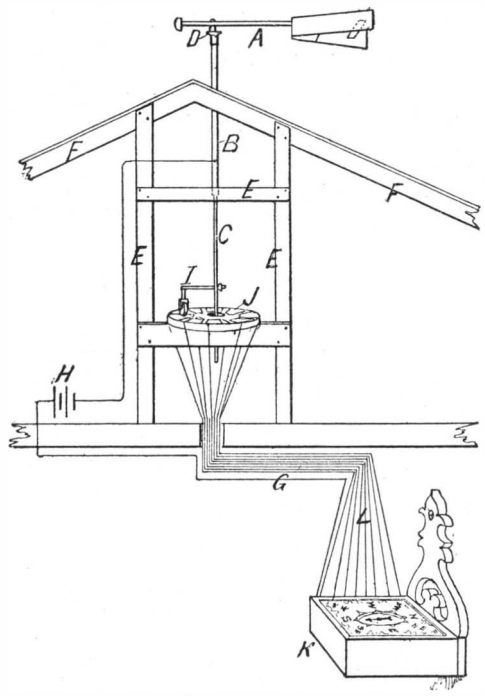


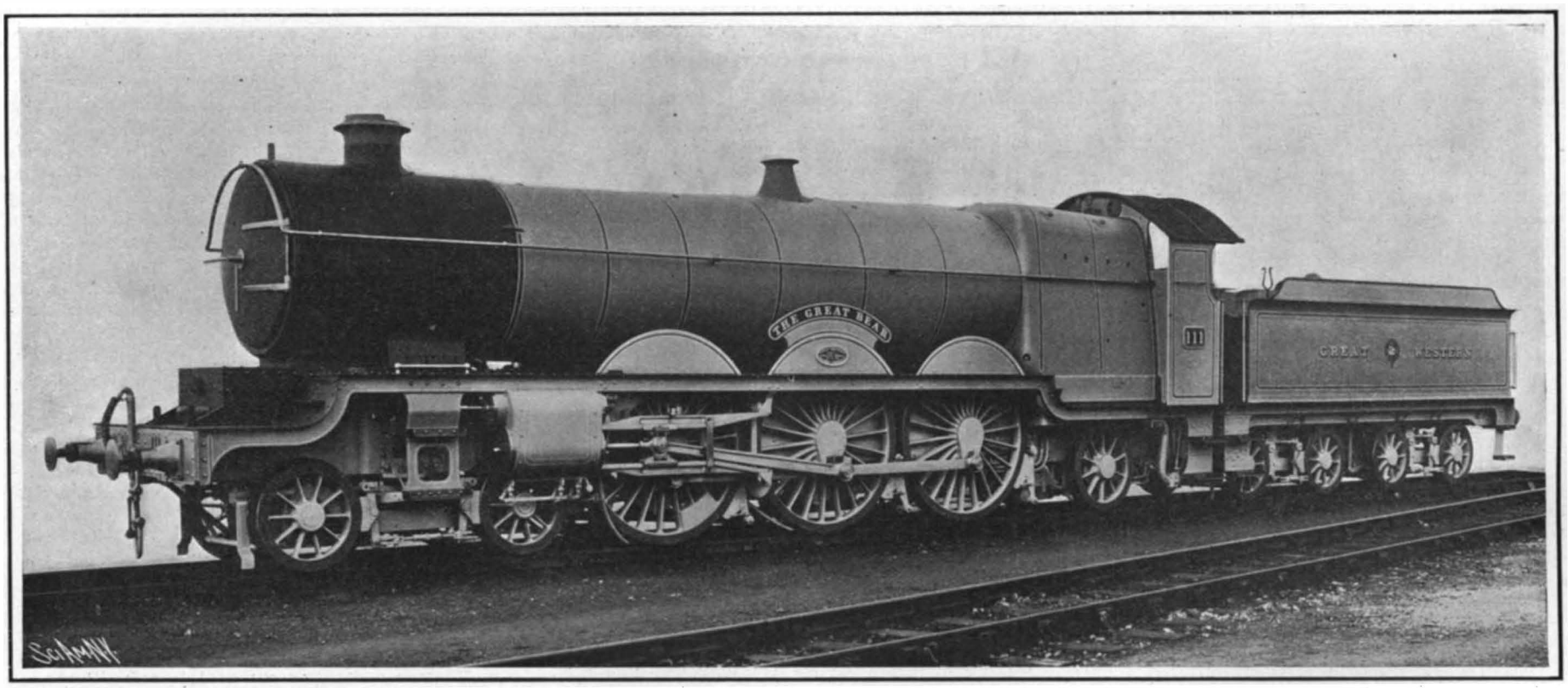
Fig. 6.—The Complete Vane, Indicator, and Electric Currents.

WEATHER VANE WITH ATTACHMENT FOR INDOOR READINGS.

BY WILLIAM H. PLACE, JR.

The fact that a weather vane must be located in an elevated and isolated position renders it difficult at times accurately to determine the direction of the wind when it blows from certain points of the compass. Furthermore, it is impossible to tell at night which way the vane is pointing. Hence, any indoor device which will at all times indicate the position of the weather vane would not be without value. Such an apparatus can be quite easily constructed by following the directions here given. Briefly stated, it consists of a compass dial having a needle actuated by electro-magnets which are individually energized according to the position of

(*Concluded on page 275.*)



Boiler: Heating Surface, 3,400 square feet. **Superheater Tubes,** 545 square feet. **Length of Fire Tubes,** 22 feet 7 inches. **Boiler Pressure,** 225 pounds. **Four Cylinders,** 15 inches diameter by 26 inches stroke. **Traction Effort,** 29,430 pounds.

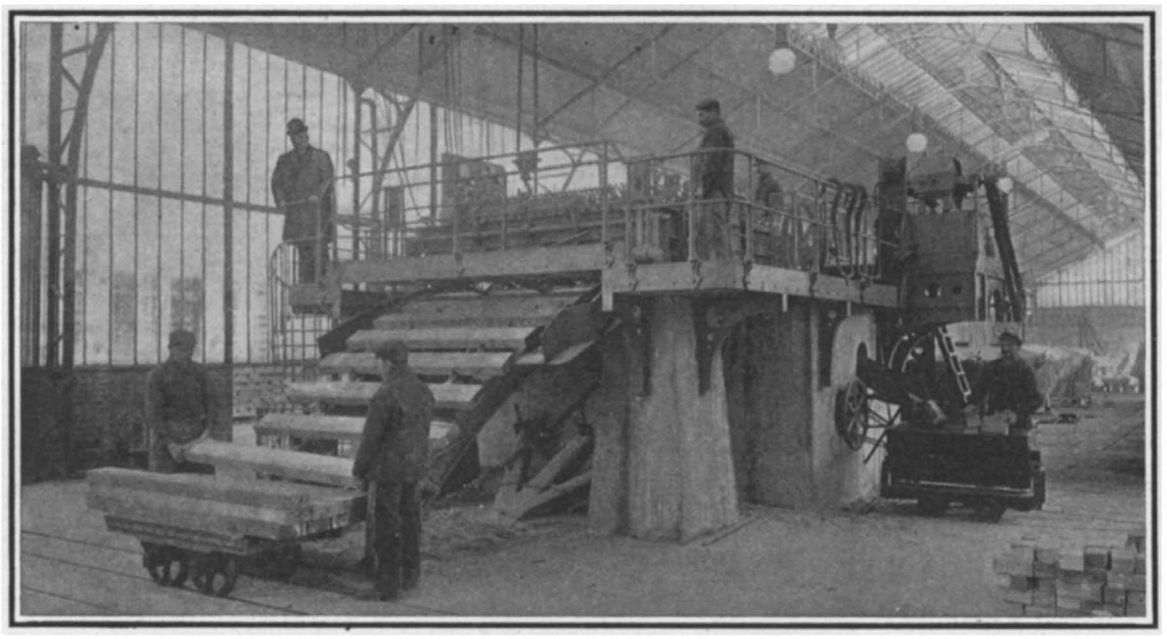
THE HEAVIEST AND MOST POWERFUL BRITISH EXPRESS LOCOMOTIVE.

A MACHINE THAT SAWS 240,000 WOODEN PAVING BLOCKS IN A DAY.

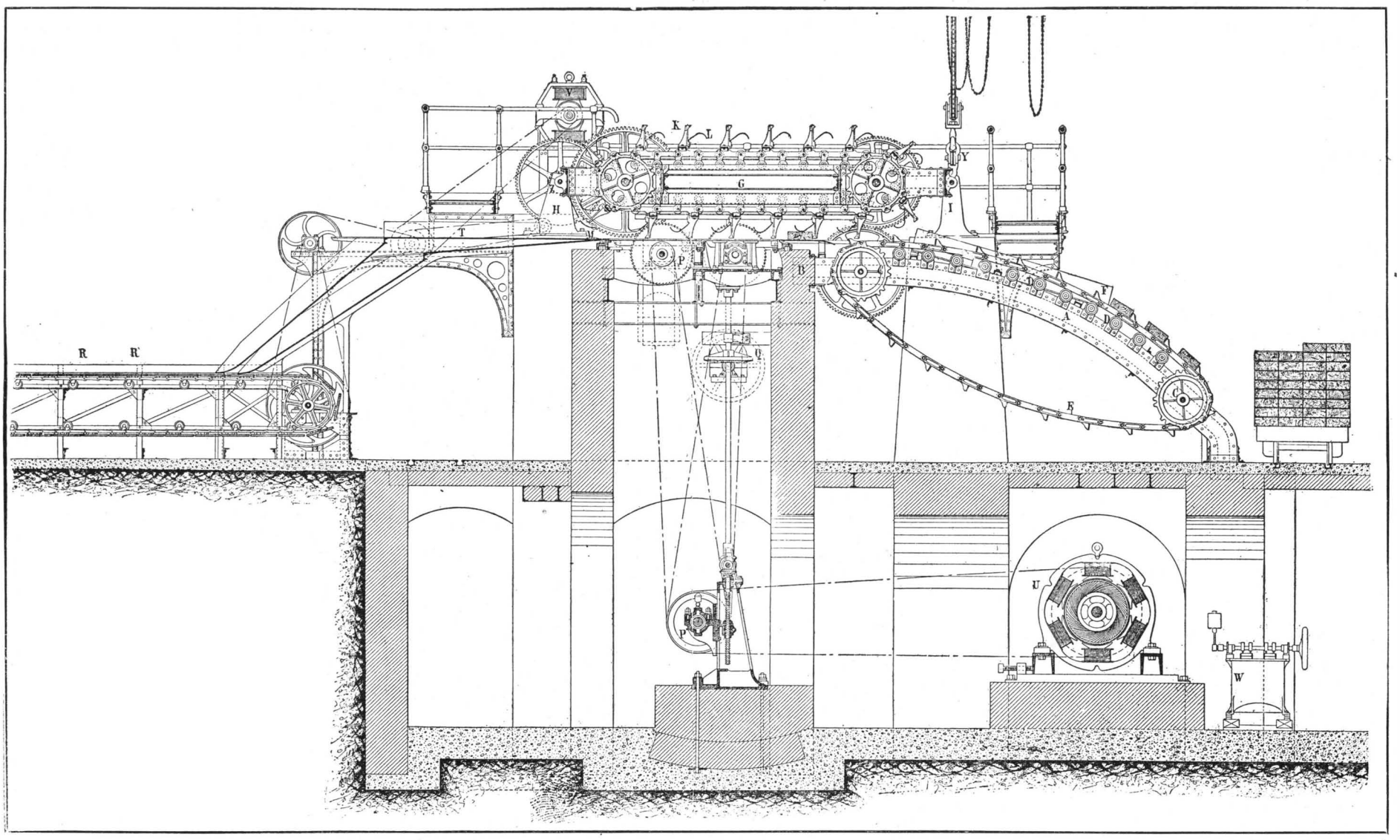
BY JACQUES BOYER.

M. Josse, the director of the municipal workshops of Paris, has invented a block-cutting machine that turns out 24,000 wooden paving blocks per hour. This ingenious and complicated mechanical device will advantageously replace the machinery and methods now in use, effecting a considerable saving in wood as well as in labor.

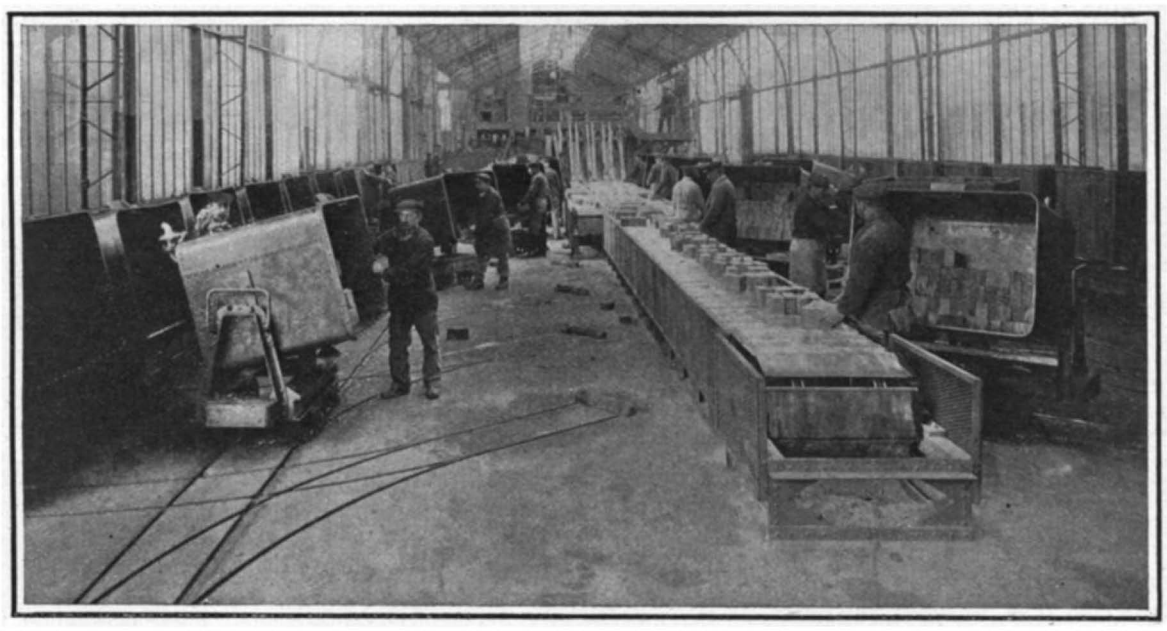
In the early days of paving with wooden blocks in Paris, the blocks were sawed with single circular or band saws. At a later period, in order to meet the increased demand, three machines containing four or five saws each were installed in the municipal workshop. Each of these machines consisted essentially of an oscillating frame, the lower end of which carried a number of saws, to which the planks were fed singly by an attendant. In 1900 this equipment became insufficient, and some more expeditious method had to be devised. It must be remembered that the daily output of a municipal shop that turns out 25 million paving blocks per year cannot be uniform unless extensive facilities for storage are provided. The trees are felled only in certain seasons, and the regularity of shipments is further impeded by the great number of purveyors and the uncertainties of the weather. Sometimes the manufacture of blocks has to be suspended for weeks, in order to take care of daily arrivals of 20 or 30 carloads of planks. The demand for blocks and the supply of old blocks are equally irregular, for paving is done only in the summer season. These old blocks are scraped and trimmed for further use in winter. Furthermore, the demand for blocks varies from year to year. Mr. Josse, therefore, endeavored to devise a machine that would accommodate itself to all these irregularities, as well as to the sudden emergencies that are inevitable in a business



View of the Machine, Showing the Conveyor for the Planks.



Longitudinal Section of the Josse Block-Sawing Machine.



Emptying the Skips of Paving Blocks.

A MACHINE THAT SAWS 240,000 WOODEN PAVING BLOCKS IN A DAY.

of this character. The result of his studies is a huge machine 100 feet long, which divides each plank into 16 blocks by means of 17 circular saws.

The planks are brought to the machine on platform cars, one of which is shown at the right of the diagram. The length of each plank is a little more than sixteen times the height of a block, as it is laid in the pavement with its fibers vertical. The width and thickness of the planks correspond to the horizontal dimensions of the blocks, when laid. Two workmen lift the planks, one by one, from the car, and lay them on a conveyor formed of two endless chains *E*, connected by transverse cleats. The chains run on sprockets *C* placed at the ends of an inclined frame *A*, and on rollers *D*, distributed along the upper and somewhat convex surface of the frame. Two sheet-iron guides *F* keep the planks in register and assure their proper delivery to the horizontal table, to which they are elevated by the inclined conveyor. The planks are pushed along this table by combs *K*, of 16 teeth, attached to two endless chains which run on sprockets. The axes *J J'* of these wheels are mounted near the ends of a horizontal frame *G*, which terminates in two shafts, one of which is free to turn in bearings on two posts *H*, while the other is supported by chains *I*. In front of each tooth of the combs is a spring *L*. The

function of these springs is to keep the planks, before sawing, and the paving blocks, after sawing, pressed to the table. Near the end of the table where the combs and springs rise and abandon the blocks, the latter are held down on the table by a set of small wheels *M* mounted on springs. Each comb carries two little brushes which sweep all waste into holes at the sides of the table.

The circular saws protrude through slits in the table. There are 17 saws, about 25 inches in diameter, mounted on three shafts, of which two are in line with each other but not with the third, *P*. This arrangement was adopted in order to avoid the excessive vibration of a single shaft as long as the planks, bearing 17 saws and making 2,000 revolutions per minute. The long shaft could not be stiffened by intermediate bearings because of the small distance between the saws. It was therefore decided to distribute the saws among three short shafts not in the same line. Each shaft is mounted on ball bearings and is driven by two belt wheels, one at each end. The bearings rest on iron beams imbedded in masonry.

Directly under the saws, in the cellar of the building, is the main driving shaft, which carries six wheels connected by belts with the wheels on the saw shafts. The driving shaft is mounted so that it can be moved up and down, to loosen and tighten the belts. This adjustment can be made from the main floor.

The saw blade is made up of a number of hinged cast-iron plates, which can be turned back for examination and adjustment of the saws. The bearings have direct lubrication. The resinous kerf which the saws accumulate from pine wood is removed by fine jets of kerosene pumped from a five-gallon tank through 3 main and 34 branch tubes and occasionally thrown on both faces of all the saws, without stopping the operation of the machine, by opening the cocks of the three main tubes that supply the three sets of saws.

Each of the two sets of saws which are in line contains 5 saws and cuts from the plank a waste end or trimming and 4 paving blocks. These two sets attack the plank simultaneously. The middle portion of the plank passes on between them to the third set, which comprises 7 saws and divides the remnant into 8 equal blocks. The 16 blocks which are thus cut almost simultaneously from the plank continue to advance along the table, pushed by the teeth of the conveyor and held down by the springs *L* until they come under the spring wheels *M*, where they remain until they are pushed onward by the following set of blocks. Thenceforward the blocks advance by steps, as they are pushed onward by new arrivals. When they reach the end of the table they slide down two inclined planes, divided into 16 compartments by vertical partitions, to the three belts of a horizontal conveyor, from which they are picked up and thrown into cars by a crew of 8 workmen. The cars, when filled, are hauled over the Decauville railway tracks to the creosoting establishment, whence the creosoted blocks go to the storage yards.

The power which operates the saws is furnished by an electric motor *U* of 110 horse-power, which is installed in the basement and connected by two belts with the main shaft *P'*. This motor is controlled by a liquid rheostat *W*, with an amperemeter and a safety cut-off. Connected with a switchboard on the main floor are two additional interrupters, an amperemeter, a voltmeter, and the controlling apparatus of a 4 horse-power motor *U*, which supplies power to the conveyors. Finally, there is a traveling crane and windlass for the removal of the saws for resetting.

The Josse machine can saw 25 planks per minute. As each plank furnishes 16 blocks, the theoretical output of the machine in a day of 10 hours is 25 x 16 x 60 x 10 = 240,000 blocks.

In practice it is necessary to make some allowance for unavoidable stoppages, etc., but a small mountain of paving blocks can be turned out in a day with the aid of 20 men or less.

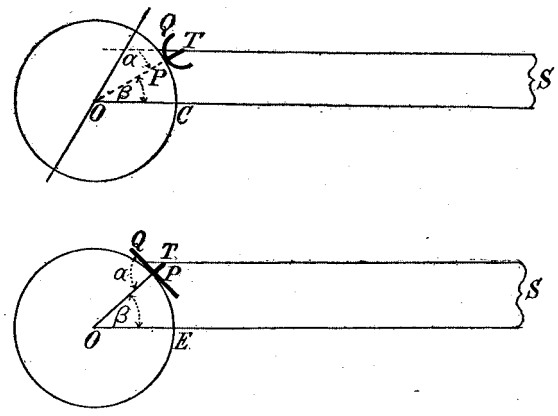
New National Forest in Arizona.

A new national forest, named the Verde, and consisting of 721,780 acres, has just been created in Maricopa and Yavapai counties, Arizona. The forest lies on the west side of the Verde River and constitutes a great part of its watershed. Jerome, where the United Verde Copper Mining Company has its headquarters, is in the northern part of the new forest reserve. To the west and southwest of Jerome are the Mingus Mountains. Most of the reserve is covered with brush that has no commercial value; but a small part has merchantable timber on it and, under proper management, will supply the neighboring mining camps. The protection of the brush-grown area is just as important as that of heavily forested land, the scrub being the only thing that conserves the water and saves the watershed of the Verde River from erosion. The protection of this watershed from damage by overgrazing and wasteful lumbering is necessary in the opinion of the officers of the Reclamation Service to the development of the irrigable lands of Salt River Valley. Hitherto the forest has been damaged by large herds of goats, which will not be prohibited from grazing in future but will be under regulation. The protection of the brush will conserve the water, which swells the Salt River and its tributaries and will help to develop the Salt River Valley.

IS THE AXIS OF THE EARTH SHIFTING?

BY J. F. SPRINGER.

It has been known for hundreds of years that the axis of the earth is continually changing its direction. To be clear as to this, recall that there is a point in



Figs. 1 and 2.

the northern sky which we term the north celestial pole and which will remain unchanged in its position to-night, although all the stars are apparently moving from east to west. There is no visible star occupying exactly this position, although the North Star approximates it. But this pole of the heavens is continually passing through a change in location. The terrestrial

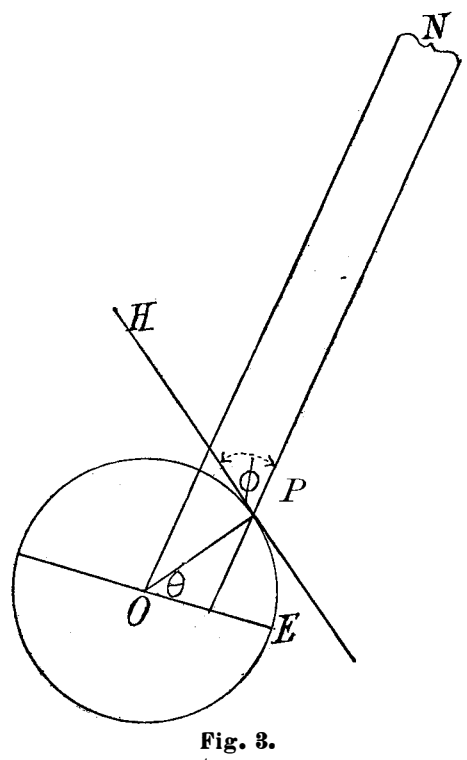


Fig. 3.

motions which give rise to the movement of the pole are technically known as *precession* and *nutation*.

But near the close of the last century, certain astronomers began to suspect that not only was the axis of the earth continually changing its direction relatively to the stars, but that it was undergoing changes in the body of the earth itself. That is, they

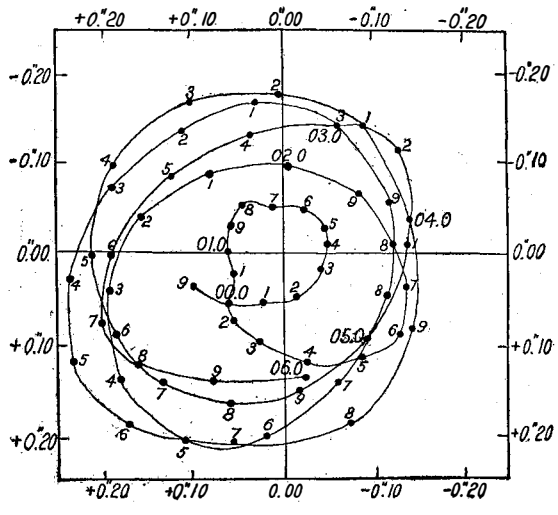


Fig. 4.

saw reasons to think that the geographical point on the earth called the north pole was shifting its position over the surface. This would mean, if true, that the latitude of New York city is not a fixed quantity. The reasons for entertaining suspicion in this matter arose from the fact that variations of such number and character came to light in redeterminations of the latitudes of certain locations, that they could scarcely be explained on the theory of errors of observation due to defects in instruments or lack of accuracy in observers.

But before saying more on the aspect which the matter has now assumed, it will perhaps be interesting to glance a moment at the question of latitude as it appeared to the ancient Greeks. In the first place, certain of their philosophers distinctly taught the globular character of the earth. They were familiar, too, not only with the conspicuous daily apparent motion of the sun from east to west, but with his annual apparent motions north and south. They noted the day when he halts in the constellation Cancer, having accomplished the end of his northern journey. This is the summer solstice. An imaginary east-and-west line through a point on the earth immediately below this position of the sun they termed the Tropic of Cancer. It was said that a well in Syene was found to be such a point. Here at noon on the day of the summer solstice the sun shone down the tube of the well. Possibly it was from such an observation that Syene was supposed by them to be on the Tropic of Cancer. In this they did not make such a great error, as its true latitude, 24 deg. 5 min. 23 sec., does not differ two-thirds of a degree from the true latitude of the Tropic of Cancer. However, they estimated it at 24 deg.

Using the Tropic of Cancer as a reference line, they were able, by means of an instrument which may be termed a *hollow gnomon*, to determine latitudes north and south. This was a hemispherical shell having a rod directed radially from the lowest point of the interior of this cup-shaped piece of apparatus. This rod terminated at the center of the sphere, and consequently was of the same length as a radius. At noon on the day of the summer solstice, the north pole would—as we know—be directed toward the sun, as shown in Fig. 1. A line from the sun to the center of the earth would pass through the Tropic of Cancer, *C*. If it be desired to determine the latitude of a point *P*, the hollow gnomon is fixed in such position that its central rod is vertical; that is, is a continuation of a radius of the earth. Its shadow is observed at the moment of noon. It is the arc *P Q*. Since *T* is the center of the shell, this arc is the measure of the angle *α*. As the sun, *S*, is very far away, the lines *S T* and *S C O* are practically parallel. Consequently, the angles *α* and *β* are equal. The number of degrees, then, indicated by the arc *P Q* is the same as the number indicated by *P C*. But this latter arc represents the latitude of *P* from *C*. This instrument is supposed to have been used by the Chinese as early as eleven hundred years before Christ. Whether the Greeks obtained their knowledge of it indirectly from them, or whether they invented it anew, is not certainly known. By this means, Eratosthenes determined the latitude of Alexandria.

But they were not limited to this one instrument. Another form of gnomon had a plane base. Upon the days of the vernal and the autumnal equinoxes, the sun is immediately over the equator at the moment of noon. It is at such an instant that the observation with this instrument was to be taken. The line *S O*, Fig. 2, connecting the sun and the center of the earth, would pass through a point on the equator. With the gnomon set up at *P* having its indicator in line with a radius of the earth, the angles *α* and *β* would be equal, as before. But *β* determines the latitude of *P* from the equator. Consequently, by determining the value of *α* by means of the lengths of the indicator *P T* and the shadow *P Q*, we should arrive at the value sought.

If one desires to satisfy himself how closely they approximated to the values determined by the refined methods of modern science, let him compare the values indicated by a good atlas with the following latitudes as given by Hipparchus:

Athens	36 deg.
Syracuse	36 deg. 44 min.
Byzantium (Constantinople)	43 deg.
Massilia (Marseilles)	43 deg.

It will be observed that the ancients were able to use these methods only at certain particular moments. In modern times, latitudes may be determined at any time of the year. There are quite a number of methods. But the following is quite simple, and will be readily understood. *N* is the pole of the heavens, Fig. 3. *E* is a point on the equator. Consequently, *N O* is perpendicular to *O E*. If no great accuracy is desired, the north star may be considered as the celestial pole. The angle *ϕ* is observed with a suitable instrument. That is to say, the elevation of the north star above the horizon is taken. Now *O P* is perpendicular to one side (*P H*) of *ϕ*, and *O E* is perpendicular to the other side *P N* (*P N* being practically parallel to *N O* on account of the great distance of the star). That is, the sides of *θ* are perpendicular to those of *ϕ*. This gives *θ* = *ϕ*. But *θ* determines the latitude of *P* from *E*, the equator. So then, the elevation of the north star above the (astronomical) horizon is exactly the same as the latitude of the place.

If it is desired to know the latitude with extreme accuracy, the value obtained by this rule must be corrected for the deviation of the north star from the true celestial pole, for the observation and refraction of light, etc.

In the eighties of the last century, Dr. Küstner at Berlin, in seeking to apply a method for the determination of the constant of aberration, was confronted with apparent errors of observation which refused to be explained by ordinary methods. Finally, he announced that the determinations of the latitude of Berlin showed a variation of 0.2 sec. to 0.3 sec. in the course of not many months. If the latitude had really changed, this would mean that the terrestrial pole had shifted from 20 to 30 feet.

It was found that the theory of a shifting pole was suggested by other facts. Finally, it was determined to set this matter at rest by an expedition to the Sandwich Islands. These are located about 180 deg. west or east of Berlin. If observations here showed a receding pole at the same time that European ones disclosed an approaching pole, and *vice versa*, then there could be no reasonable doubt that the axis of the earth is not fixed relatively to the earth itself. The United States government sent an officer to participate in the observations in the Pacific. Concurrently with these, similar work was carried on in the United States, in Berlin, and other places. The result of this work was to confirm the suspected shifting of the axis.

About the time of these occurrences, Dr. S. C. Chandler at Cambridge, Mass., became aroused over the same subject. In examining a series of determinations of latitude, he found not only variations, but that these variations appeared to conform to some law. At first, he felt that while the discrepancies seemed to indicate a shifting pole, this was too startling a proposition to put forth without further confirmation. However, after an immense amount of labor, he established the fact that two periodic influences were at work, at times co-operating to shift the pole to a maximum distance, and at others to limit its variation to a very small minimum. One of these influences was a yearly one; the other had a period ranging from 12½ to 14½ months. The combination of these two influences produced a cycle of about seven years.

The amount of displacement to which the north pole is thus subject is about 30 or 40 feet from a mean position. Dr. Chandler's first announcement was made in 1891.

In 1893 the fact of polar variation was pretty well admitted. The International Geodetic Association undertook the task of carrying on the observations and reducing them to order. At times they established four observational posts at widely separated points, but within about 12 sec. of the same degree of latitude; that is, at about 38 deg. 8 min. N. These were at Carloforte, in the island of San Pietro; Mizusawa, Japan; Ukiah, California, and Gaithersburg, Maryland. The officer of the last-named station is an officer of the U. S. Coast Survey. Aside from him, the expense involved is about $14,000 annually. Tschardjui in Siberia and Cincinnati, Ohio, have joined in the work. More recently, the association has added two more stations in the southern hemisphere—one in Australia and the other in South America.

Fig. 4 is a curve representing the polar movement. This covers a period of six years, divided into tenths from 1899.9 to 1906.0. These points of time are indicated by the numbers shown on the *curve*. By referring to the numbers shown on the *margin*, the extent of the movement may be accurately noted, remembering that 1 sec. of arc is equal to about 100 feet.

The discoveries and investigation of Dr. Chandler have removed a mass of discordant results in the national observations of Great Britain, Russia, and the United States from the field of unaccountable error to that of agreement with fact. Indeed, the accuracy of both instruments and men had been under suspicion.

These results are valuable. Thus, one method of determining the solar distance is by means of the *constant of aberration* of light. This in turn is affected by variation of the rotational axis in the body of the earth. The reason for this is that it is necessary to know the position of the observatory in order to carry on the calculations. This it will now be possible to ascertain with a very high degree of precision.

WEATHER VANE WITH ATTACHMENT FOR INDOOR READINGS.

(*Concluded from page 272.*)

the weather vane. To make the vane, procure the front hub of an old bicycle which contains all the ball bearings, a piece of galvanized iron rod, 6½ feet long, of the same diameter as the spindle in the hub to which the cones are attached, and a piece of brass tubing 4 feet long the inside of which will snugly receive the end of the hub by driving it in. First saw off a foot and a half from the rod, then take the spindle out of the hub, saving the cone *D*, which is tapped. Now saw the hub in two in the center. On the end of the 5-foot piece of rod *C* for a length of 1 inch cut a thread, corresponding to the tap in the cone *D*. Measure half an inch from the end of the thread, and file a shoulder one-sixteenth of an inch all around; then measure 9 inches from the other end and drill a ⅛-inch hole. Take the remaining foot and a half of rod *A* and drill a hole 7 inches from the forward end which will fit over the filed end of the rod *C* down onto the shoulder. Take a half ball *M* from the end of an old curtain pole and fasten to the forward end of the rod. The tail of the vane must be made with two spreading boards on the sides, braced in the center, and nailed to a firm block into which the end of the rod is driven. After this is done melt up some lead and pour into the half ball *M* until the rod balances on the point where the hole has been drilled. Screw the cone *D* on the rod as tightly as possible, and after placing the vane down over the point onto the shoulder, rivet it on, being sure that it points in the same direction as the hole drilled near the lower end. Now drive the sawed end of the hub into one end of the brass tubing and the vane is complete (Fig. 1).

A contact table should now be made as follows: The table is a circular board 6 inches in diameter and ½ inch thick on which eight sheet brass segments or points of contact *J* are arranged as in Fig. 2 to form the eight points of the compass. A ½-inch hole should be bored through the center of the table. To connect the vane to the table in order to form a circuit a small brass pulley wheel *I* is used; this can be bought at any hardware store. The wheel should be about ¾ inch in diameter and have a long wood screw on the end of the brass yoke in which it revolves. The wood screw must be sawed off so that a piece of brass rod 3/16 inch in diameter and 2½ inches long may be soldered on in its place at right angles to the yoke and in the plane of the wheel. An annular shoulder half an inch from the end and a thirty-second of an inch deep must be filed in one end of the short piece of brass rod, the other end of which should be soldered where the wood screw was cut off as stated above. The rod should be threaded as far as the shoulder and a nut procured to fit the thread (Fig. 3).

To make the reading instrument or indicator procure eight single magnets 1 inch long wound with No. 24 single cotton-covered copper wire, also eight screws ¼ inch longer than the taps in the magnets, and eight copper burrs with holes in them large enough for the screws to slide through easily. Now make a board for the magnets to be placed on 6 inches square and ⅜ inch thick, and eight wooden blocks 1 inch square by ¼ inch thick. Drill a hole in each of the blocks large enough for one of the screws to go through easily.

Describe a circle with a diameter of 1¾ inches in the center of the 6-inch board, and draw lines in it representing the eight points of the compass, viz.: N, S, E, and W, NE, SE, NW, SW.

Lay the magnets *N* radially around this circle, as shown in Fig. 4. Now at the other end of each magnet nail the little blocks which are set up on edge, and secure each magnet in place with a screw which has been run through a burr, to prevent the head of the screw from sinking into the block. Now connect all the inside magnet wires to a main wire *P* extending around the board about ½ inch from the ends of the magnets. Bore nine holes through the 6-inch board, one at the end of each magnet and one for the main wire to go through. Place the board and magnets in a box *K* with a glass cover which will exactly contain them. Now make a small wooden cone, insert in it a small steel needle and place it in the center of the circle around which the magnets are arranged. A small arrow-shaped piece of steel *O* must be balanced delicately on the cone after the manner of a compass needle. A paper face 6 inches square with a hole in the center 1¾ inches in diameter may be placed over the magnets. This may be as elaborate as desired (Fig. 5).

Set up as per diagram, being sure that the weather vane is a foot above the roof, and away from all trees, buildings, chimneys, or other obstructions.

The main wire is soldered to the piece of brass tubing *B* and run to the batteries *H*. Thence a line *G* runs to the main wire *P* of the reading instrument *K*. A wire *L* should be soldered to each of the segments on the table *J*, and at the reading instrument should be connected with the corresponding magnet, i. e., the segment pointing north should be connected with the north magnet, etc. It will now be seen that if the weather vane points north it will turn the iron *C*, to which the brass wheel *I* is attached, to the north segment, thereby closing the circuit with the north magnet in the reading instrument. That magnet will become magnetized and will attract the steel needle around to it.

There are many valuable woods in Colombia. Where required, they are used locally, but difficulties of transport, and the phenomenal weight of some of the most useful kinds—e. g., guayacan and diomate—almost preclude export to other countries.

Correspondence.

Automatic Fire Valves.

To the Editor of the SCIENTIFIC AMERICAN:

With reference to article written by Mr. Frederic Bradlee Abbott in your issue of January 25, the writer cannot agree with Mr. Abbott for several reasons. First is that it has been positively proved that in a fire panic, persons have absolutely neglected to use any safety precaution, either for the safety of themselves or building they may be in, when a fire occurs. Depending on some one to turn a valve or allow water to enter the perforated pipes, as Mr. Abbott mentions, is out of the question.

In the second place, if the valve should be opened by a person, thousands of dollars of damage might occur before some one could get to the valve to close it. It would be left to the judgment of the occupants whether or not the fire might be of sufficient magnitude to warrant turning on the water and wetting everything in the building, and possibly causing ruin to the entire building. My opinion is that the sprinkler system, uncharged with water, is the safest and best protection that can be given for the immediate extinguishing of fire, together with the protection of lives and property. An automatic valve placed below the frost line or in the boiler room of a building, in connection with the sprinkler system, is in my estimation the best protection thus far afforded.

Chicago, January 24, 1908. J. E. OSMER.

Hammer Blow of Poorly Balanced Locomotives.

To the Editor of the SCIENTIFIC AMERICAN:

I read with interest the retrospect for the year 1907 given in your valuable paper. The one that appeals to my mind as of the greatest importance, in relation to the unsafety of railway travel, was the special report of the Railroad Commission of the State of New York. The report says that in the winter months of 1907 nearly three thousand broken rails were removed from the tracks in that State alone. It seems to me that it is about time for the State to apply the remedy which is not far to seek. It has been shown from numerous experiments made by Prof. Goss that the counterweight in the locomotive driving wheels strikes a blow of 25 tons at each revolution—enough to break any rail under proper conditions of cold and frosty weather. They can remove at once this element of destruction, which is a relic of a prehistoric age, and make the conditions the same upon both sides of the center of revolution, thus eliminating this blow and bringing the locomotive into perfect balance. Who ever heard of a rail breaking under a locomotive at rest upon the rail? Neither will it break under a high rate of speed, if properly balanced; nor leave the rail by centrifugal force, as they frequently do without any apparent cause, leaving destruction all along the line.

Another reason for the removal of this relic of the past ages is the inefficiency of our locomotives produced by it. There are few machines that I have any knowledge of—in fact, I cannot recall any—whose transmission of power through frictional contact is as great as the locomotive engine. It is also well known that this contact must be constant to produce the best results. Let us look for a moment and see what occurs; in the downward movement of this counterweight we have the stress or blow; in its upward movement we have the lift from centrifugal force, a constant making and breaking of contact of the wheels with the rail, thereby losing its efficiency.

It is not only our locomotives that are off the track (owing to their construction), but our builders seem to think that with a tremendous boiler and cylinder capacity they have a tremendously powerful locomotive, without one thought as to the transmission of that power through the small frictional contact. The earning power of the locomotive lies in its contact of the wheels with the rail, and not in its boiler capacity.

In closing let me make a suggestion or two:

1. Balance up the locomotive and avoid that blow, and keep it in constant frictional contact, thus increasing its efficiency.

2. Reduce the size of the locomotives 20 tons and do the same work. This can be done if the friction is constant.

A locomotive constructed as I suggest will be much more safe at high speed, and there will be a great many less broken rails and accidents.

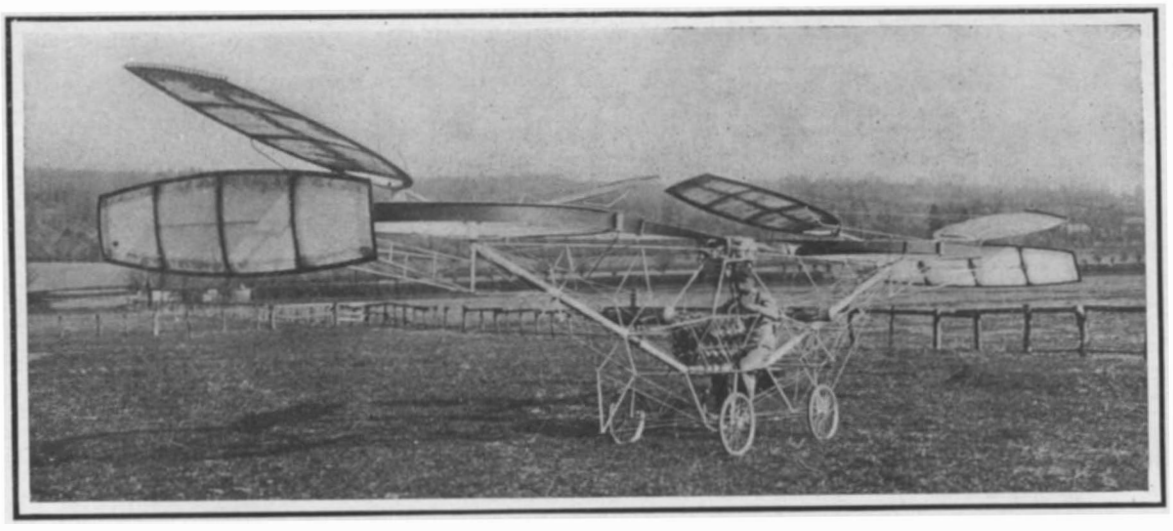
HENRY F. SHAW,
Mechanical engineer of the old school.
176 Corey Street, West Roxbury, Mass.

[Much attention is being paid to the question of locomotive balancing. The best results have been obtained by the use of four cylinders, with the adjoining cranks set in pairs at 180 deg. There can be no doubt that insufficient or intermittent adhesion, due to imperfect balancing, accounts for much loss of hauling power in some locomotives, when they are running at high speed.—ED.]

SUCCESSFUL TEST OF THE CORNU HELICOPTER.

A little over a year ago we described a test of a model helicopter constructed by M. Paul Cornu. This model weighed about 30½ pounds, and was fitted with a 2 horse-power gasoline motor. In the tests which were made of it, it rose vertically in the air and also, when the aeroplanes were set so as to receive the blast of air from the lifting propellers, it traveled along in a horizontal direction.

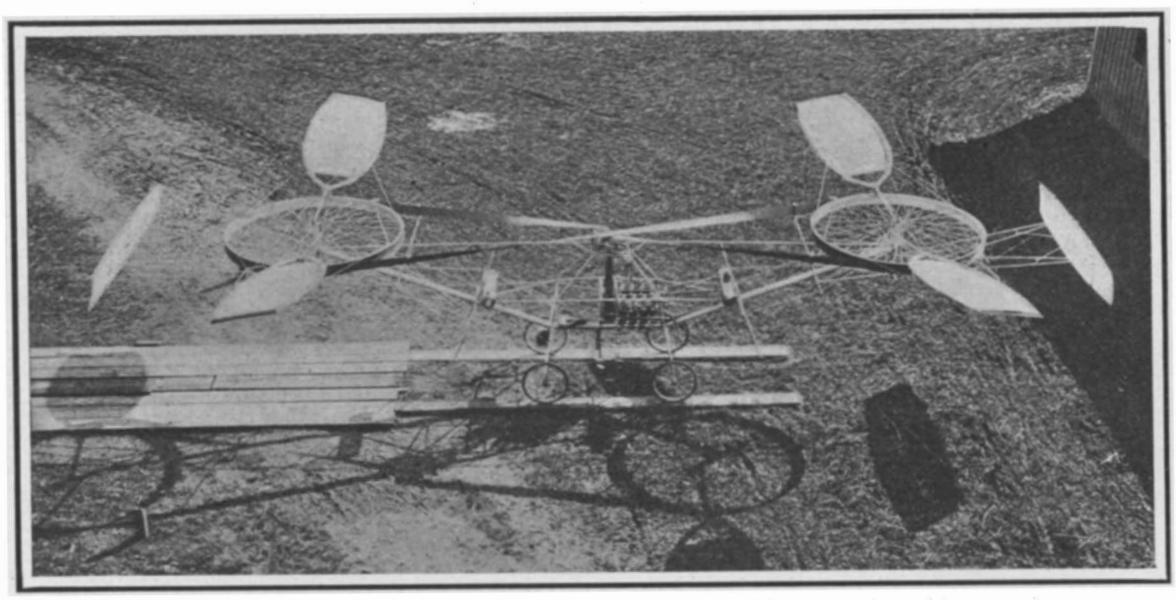
M. Cornu has recently completed a full-sized machine constructed along the same lines as the model. This machine is shown very well in the accompanying photographs. As can be seen, it consists of two horizontal 2-bladed propellers mounted upon horizontal wheels or pulleys. The pulleys are carried upon a suitable framework, the main member of which consists of large-diameter steel tubing arranged in the form of a wide U, in the bend of which is mounted an 8-cylinder Antoinette motor of about 24 horse-power, and also the aviator's seat. The backbone and superstructure of the machine are carried upon a 4-wheeled chassis, so that it can be run along on the ground. Such motion, however, is not necessary for the machine to rise in the air, as it is supposed to lift vertically, and afterward, when it is in the air and the aeroplanes seen at each end are set at the proper angle, to be driven along horizontally by the reaction of the air from the propellers. The pulley wheels carrying the propellers are driven by a long belt, that is crossed and passes over a pulley on the end of the motor crankshaft.



The Cornu Helicopter as Seen from One End.

The 8-cylinder motor, shown in the center of the machine, drives the two large pulleys by means of a belt. The aeroplanes seen at each end can be set at different angles in order to cause the machine to move forward from the air reaction of the propeller blades upon them.

The first test of his new machine was made near Lisieux, France, the first week in April. It was successful in as far as the lifting power of the machine was concerned, although the inventor could not make it travel in a horizontal direction. In the test he rose off the ground a distance of a foot or two. His machine is the first real helicopter to rise off the ground with its own power and carry a man, that has been brought out in France. A much larger machine of similar type—the Breguet-Richet gyroplane—succeeded in rising vertically into the air for a short distance some months ago, but in both cases the inventors have found that this is only half the problem. While it is comparatively easy to rise vertically, it is much more difficult to construct a machine that can be made to travel in a horizontal direction when once it is in the air. The helicopter is one of the most alluring types of flying machine, but from present indications it is one that will not be developed for some years to come, or not until after the aeroplane has reached a comparatively high degree of perfection. There has been considerable experimenting with machines of this type, but very few of them have shown any indications of success.



Plan View of Helicopter, Showing Arrangement of Motor, Driving Belt, and Aeroplanes at Ends.

The propellers are 6 meters (19.68 feet.) in diameter and make 90 R. P. M. The total weight lifted was 260 kilogrammes, or 853 pounds, so that the weight lifted per horse-power was about 35 pounds—the best that has yet been done.

Electric Telephotography.

A Swiss inventor, Eugen Frikart, has taken out a German patent on a method of electric telephotography, which should attract considerable attention. Of course, every one has heard of the wonderful achievements of Prof. Korn, of Munich, in this line. By means of a metallic conductor he transmitted to a distance of about six hundred miles, photographs and handwriting. But, according to the Berner Bund, Frikart has gone still further, as he can transmit with his apparatus pictures and writing over still greater distances without any metallic connection between the sending and the receiving station, the transmission taking place on the same principle as wireless telegraphy. It is possible, for instance, to transmit from Bern to Berlin, in five minutes, a facsimile of a piece of manuscript, without using any conductor. The transmission can take place at any time of the day, no optical apparatus being necessary. Further, only the instrument for which the picture is intended can receive it. Such an invention should have great value for communications between vessels and the land. (A German paper naturally adds "especially for the police.") To vessels that are several days from land, photographs can be sent; airships can transmit to any desired distance, or in any direction desired, photographs of fortifications over which they sail. The receiving apparatus makes the picture directly, it is said, without any chemical process, on the paper, and produces either one or more copies at once.

In sending, the picture is divided by the apparatus into several points of equal size, grouped together more or less thickly, according as the place in question is dark or light. Each of these points is transmitted by a roller, such as one finds in a phonograph, by means of a spark discharge, to the receiving apparatus, and there, by means of a tracing point, it is visibly and permanently fixed on a similar cylinder. Naturally, the cylinders of the sending and the receiving apparatus must have exactly the same rotation speed; this is also regulated electrically without the use of metallic conductors. There are still many difficulties which the new invention has to combat, but it is hoped that it will soon reach the same state of perfection as the wireless telegraph.

The Cubic Contents of Ocean Areas.

The mean height of all the land now above the sea is referred to by Lyell as being 1,000 feet. The mean depth of the ocean is at least 12,000 feet, that is, it exceeds the height of the land twelve times. This is because the extreme heights of the land, although probably no less than the extreme depths of the sea, yet are exceptional heights, while the ocean maintains its depth over enormous areas. Owing to the fact that the surface of the ocean to that of the land is as two and a half to one, the ocean would accommodate the whole of the land thirty times over, were it all pitched into the ocean areas.—Knowledge and Scientific News.

Only flaming arc and high-efficiency incandescent lamps are used in the business portions of Berlin, and 90 per cent of the outdoor lighting is now done with flaming arc lamps. Both tantalum and tungsten lamps are used, but the former are seen usually in old fixtures where the lamp cannot be placed vertically.

THE UNITED STATES BATTLESHIPS "DELAWARE" AND "NORTH DAKOTA."

When Great Britain, which sets the fashion in warship construction, had brought out the "Dreadnought," each of the other leading naval powers set about designing a "Dreadnought" of its own. France laid down the "Danton," an 18,400-ton ship, carrying four 12 and twelve 9.4-inch guns. Germany produced the 17,710-ton "Ersatz-Sachsen," which is generally credited with carrying sixteen 11-inch guns. Japan laid down the "Satsuma," an 18,800-ton ship mounting four 12's and twelve 10's. The answer of the United States was the "Delaware," of 20,000 tons displacement, carrying ten 12-inch guns as its main armament.

Although we have spoken of the "Delaware" and "North Dakota" as being the first of our "Dreadnoughts," it is quite a question whether the "South Carolina" and "Michigan" are not entitled to be called the first of this class. They fall below it chiefly in their displacement, which is only 16,000 tons; but they carry a main armament of eight 12-inch guns and therefore are entitled to rank in the all-big-gun class. These ships, moreover, have a main armor belt which is 16 feet wide and varies from 8 to 11 inches in thickness. The speed is 18½ knots, and the maximum coal capacity 2,200 tons. Taken altogether, then, they would seem to be well qualified to "lie in the line" against any of the modern "Dreadnoughts" which may oppose them.

The "Delaware" and "North Dakota" represent a great advance, on practically every point of comparison, over any existing ships of the United States navy. The most notable increase has been in the displacement, which on the normal draft will be 20,000 tons, or 4,000 tons greater than that of the next largest of our battleships. They will be 510 feet in length between perpendiculars and 518 feet 9 inches in length over all. They are 85 feet 2½ inches in breadth on the load water line, and at their normal displacement of 20,000 tons, when they will be carrying two-thirds of their full supply of ammunition and stores and about 1,000 tons of coal, they will draw 26 feet 11 inches of water. At full load displacement with full supply of ammunition and stores and 2,500 tons of coal in the bunkers, they will displace 22,060 tons.

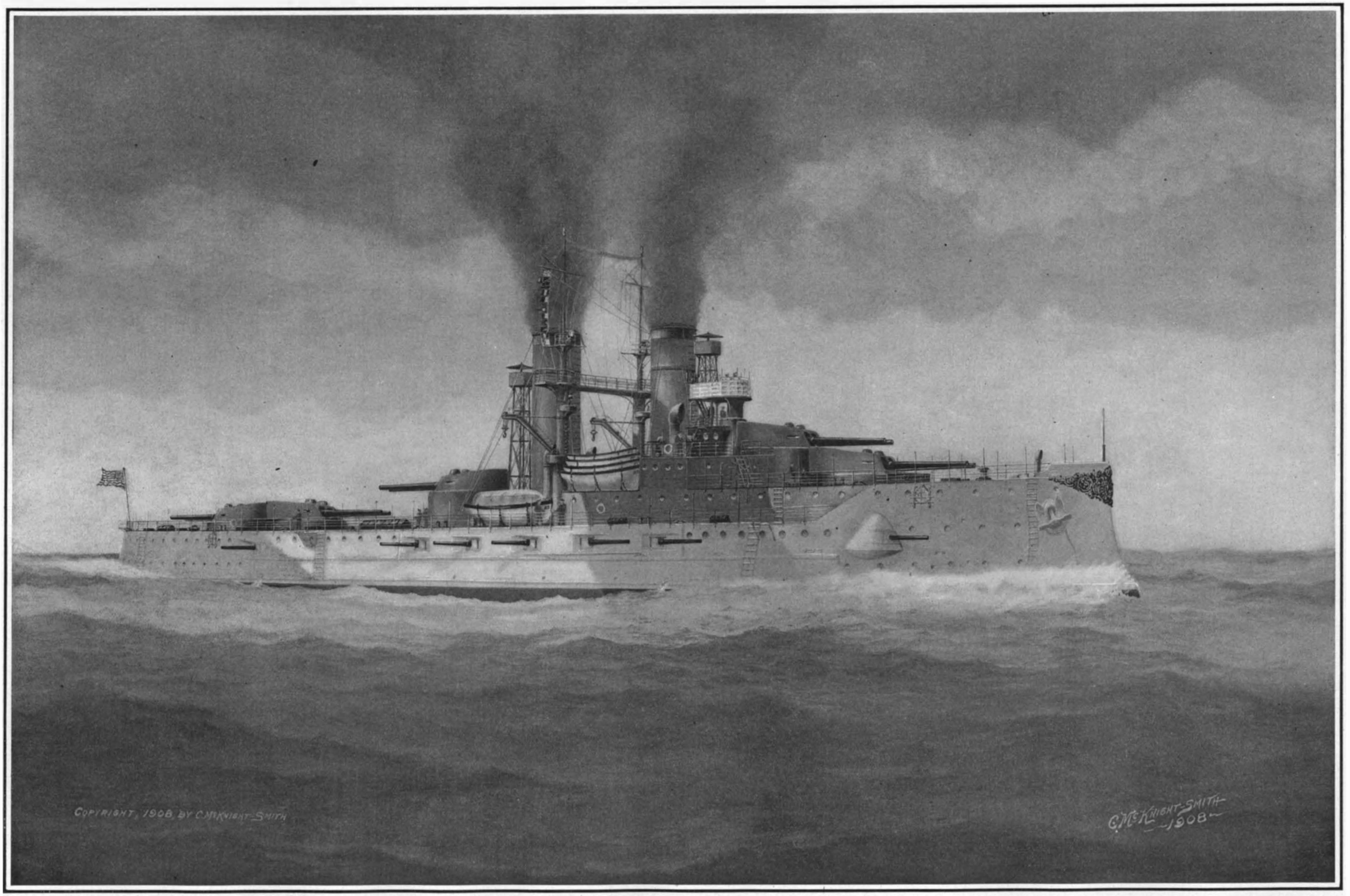
The "Delaware" is being built by the Newport News Shipbuilding Company, and the "North Dakota" by the Fore River Shipbuilding Company. Work on these two ships was commenced last October and is proceeding favorably, particularly on the "North Dakota," which on March 31 last was 25.7 per cent completed. The progress on the two ships is shown month by month in the accompanying table:

Month	Delaware	North Dakota
October 31, 1907.....	2.33	4.23
November 30, 1907...	5.08	7.84
December 31, 1907....	7.05	12.70
January 31, 1908.... .	9.20	17.50
February 29, 1908....12.77		21.40

If this rate of construction be kept up on the "North Dakota" she will be completed considerably within her contract time.

The great length of the "North Dakota" and the fineness of her model, as rendered necessary by the high speed of 21 knots, which she is expected to attain, necessitated an increase in the height of the freeboard forward to enable her to steam comfortably into head seas. Consequently, a forecastle deck has been provided, extending from the stem to abreast of the forward smokestack. This deck has a freeboard at the stem of 25 feet 9 inches and abreast the forward turrets of 25 feet 1 inch. From the forward smokestack the main deck runs flush to the stern, with an average freeboard of about 18 feet. The freeboard amidships, as designed, is 17 feet 10 inches on a draft of 26 feet 11 inches. The decks of the ship have been kept as free as possible of all incumbrances with

A NEW FRENCH HELICOPTER.



Length, 518 feet 9 inches. **Beam,** 85 feet 2½ inches. **Normal displacement,** 20,000 tons. **Speed,** 21 knots. **Coal,** 2,500 tons. **Armor:** Belt, 9 to 11 inches; upper belt, 8 to 10 inches; citadel, 5 inches; turrets, 8 to 12 inches. **Armament:** Ten 12-inch; fourteen 5 inch guns. **Torpedo tubes,** two 21-inch. **Complement,** officers and men, 933. **To be completed** in 1910.

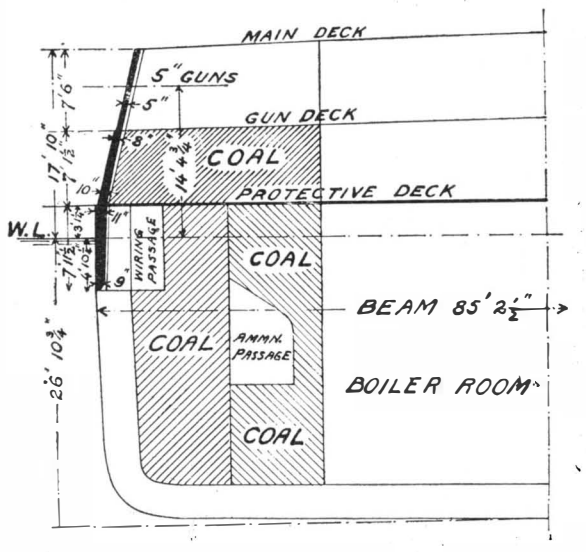
THE ALL-BIG-GUN 20,000-TON BATTLESHIP "NORTH DAKOTA."

a view to enabling them to present a glacis above which the 12-inch guns may fire without obstruction. Also, the top hamper in the way of boat cranes, flying bridges, etc., has been reduced to the lowest possible limit, and the masting and standing gear have been also simplified.

The battery of ten 12-inch 45-caliber guns is disposed as follows: Forward on the forecastle deck are two two-gun turrets, arranged one behind the other on the axis of the ship, and as close to each other as is consistent with sufficient clearance for turning. No. 1 turret carries its guns at a height of 31 feet 5 inches above the normal water line. The guns of No. 2 turret which fire above the roof of No. 1 have an elevation of 39 feet 5 inches above normal water line. These guns have a fine command and are carried at a height which will insure their being fought in any reasonable weather. Immediately back of turret No. 2 is a conning tower protected by 12 inches of nickel steel, with its slots showing just above the roof of the turret in front of it. Above the conning tower is a small navigating platform, and above this, carried on an open latiice-work tower, is a lofty "fire control" platform, on which will be stationed the officers who will operate the range finders, note the splash of the shells, and telephone the range and other directions as to fire to the different gun stations throughout the ship. The "North Dakota" has two smokestacks of moderate height, the bases of which will be armored sufficiently to keep out the lighter rapid-fire shells. Between the smokestacks and abreast of each other, one on each beam, will be the two hollow steel masts, each of which will serve as the mast for a boat derrick for handling the few ship's boats which will be carried. Two of these boats will be on the main deck, and there will be two nests of four each abreast of the forward smokestack on the forecastle deck. The two masts will be connected by a lofty flying bridge, below which will be small platforms containing independent compasses. Immediately abaft of the after smokestack will be a second lofty fire-control platform, carried upon an open latticework tower, similar to the one above the conning tower. Immediately abaft of this will be turret No. 3, whose guns will be carried at an elevation of 32 feet 2 inches above the water line. About 50 feet farther aft on the main deck will be turret No. 4, and immediately abaft of this, separated only by sufficient room for clearance, will be turret No. 5. The guns in turrets 4 and 5 will be carried at an elevation of 24 feet 2 inches above the normal water line. All 12-inch guns can fire on each broadside, and four 12-inch guns can be fired dead ahead and four dead astern.

For repelling topedo boat attack the "North Dakota" will carry fourteen 5-inch 50-caliber guns, all of which will be mounted upon the gun deck, with their axes at an elevation of 14 feet 4 inches above normal water line. Ten of these guns will be carried in a central citadel amidships, protected by a continuous wall of 5-inch armor which will be carried entirely around the citadel, the bulkhead armor at the ends serving to protect the guns against a raking fire. Between each of the guns a transverse wall of armor will extend inwardly to a junction with a rear wall running parallel with the axis of the ship. Each gun will thus be emplaced in a completely inclosed casemate; so that the destruction wrought by a shell will be confined to the particular casemate in which it may burst. The other four 5-inch guns will be mounted in separate casemates, two forward and two aft. These last four casemates will be sponsoned out sufficiently to enable the guns to fire slightly across the line of the axis of the ship, thus cutting out any dead angles and enabling the 5-inch battery to sweep the whole arc of the circle.

Particular attention has been paid in these ships to the protection of buoyancy and the preservation of the longitudinal strength of the ship. In the first place, the framing, which is deep and heavy, is carried up to the level of the protective deck, which is not sloped down to the bottom of the armored deck, as in previous ships, but is carried out to a junction with the top of the armor belt at a height of over 3 feet above the normal water line. With a view to increasing the girder strength of the ship (a necessary precaution in view of the great length of the ship and the enormous concentrated weight of the turrets) the protective deck is made unusually heavy, and four complete longitudinal bulkheads are provided in the position shown in our cross-sectional view of the ship. Immediately back of the armor belt is a "wiring" passage in which the various electrical cables will be placed. Far below the water line and in the second longitudinal compartment between the two interior bulkheads, will be built an ammunition passage, provided with rapidly running travelers for the transfer of ammunition. The whole of the space amidships between these two bulkheads and the side of the ship will be filled with coal except where it is otherwise



Cross-Section of "North Dakota" Showing the Protection Afforded by Heavy Armor and Coal Storage.

occupied by the two passageways above referred to. The space between the protective deck and the gun deck will also be filled with coal; and it will be seen at a glance that this arrangement, coupled with the 15-foot armor belt from 8 to 11 inches in thickness, will afford protection of an unusually satisfactory character to the stability of the ship against gun and torpedo attack.

In addition to the armament as above described, the "North Dakota" will carry four 3-pounder and four 1-pounder semi-automatic guns, two 3-inch field guns for use with landing parties and two .30 caliber machine guns. She will also be provided with two submerged tubes for firing the new 21-inch torpedo.

The water line and side of the ship will be protected by a wall of armor 22 feet 8 inches wide, reaching from about 5 feet below the water to the main deck. The lower belt will be from 9 to 11 inches in thickness; the upper belt from 10 to 8 inches, and the citadel armor 5 inches in thickness. Back of the thicker armor will be about 20 feet of coal. The 12-inch guns will be protected by 8 to 12 inch armor on the barbettes and the turrets.

The motive power of the "Delaware" will consist of water-tube boilers and triple-expansion engines of 25,000 horse-power. The "North Dakota" will be driven by two Curtis turbines of the same horse-power, and the estimated speed of the ships is 21 knots. The contract price of the hull and machinery of the "Delaware" is $3,987,000 and the contract date of her completion is August 6, 1910. The contract price of the "North Dakota" is $4,377,000, and she is to be completed June 21, 1910. The total cost of each of these ships, by the time they go into commission, will be not far from ten million dollars.

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PUCK'S CONCEPTION OF THE SCIENTIFIC AMERICAN.

New Compounds of Molybdenum and Silicon.

New compounds of molybdenum and silicon have been investigated in Paris by M. Ed. Defacqz, and he described his method at a recent meeting of the Académie des Sciences. By means of the electric furnace or the alumino-thermic process, various compounds of silicon and tungsten may be formed. The same method can be applied to obtain compounds of molybdenum, and the author finds that among these the silicides of molybdenum are easily formed. As regards such compounds in general, it may be stated that silicon and molybdenum can be made to combine directly in the electric furnace, as was shown by Prof. Moissan and others. By melting a mixture containing silicon and oxides of molybdenum we obtain a mass from which the compound Mo_2Si_3 is set free. M. Defacqz's researches relate to another compound, which is the bisilicide. In the electric furnace is heated a mixture of silicide of copper and amorphous molybdenum, the latter being obtained by reducing the oxide of the metal by hydrogen at a red heat. The proportions are as follows: silicide of copper containing 50 per cent silicon, 90 parts, and amorphous molybdenum, 10 parts. Using a current of 800 or 900 amperes and 50 volts, the heat lasts for 1½ minutes or more. As to the properties of the compound Si_2Mo or bisilicide of molybdenum which is thus obtained, it appears in light gray metallic crystals. Under the microscope these are seen as needles of octahedral crystals. The density of this body is found to be 6.2 at the freezing point. It is non-magnetic. Chlorine gas acts upon it, and the silicide is seen to glow in this gas at a temperature of 660 deg. to 750 deg. F. In this case there is a formation of chloride of silicon and pentachloride of molybdenum. When heated by the blowpipe upon platinum foil in the air, this body is not altered. Acids have but little effect upon it. A mixture of nitric and hydrofluoric acids will dissolve it at a moderate heat and form a clear liquid. Evaporating this *in vacuo* we have a residuum of molybdic acid. Soda or potash in fusion, or alkaline carbonates react upon it to give a mixture of alkaline silicates and molybdates. Analysis gives the new compound the formula Si_2Mo.

PUCK'S CONCEPTION OF THE SCIENTIFIC AMERICAN.

Our contemporary Puck published in one of its recent issues illustrations which it considers typical of certain periodicals, among them the Scientific American. We reproduce the illustrations for the delectation of those readers of the Scientific American who wish to see themselves as Puck sees them. The coatless, bald-headed man of the dripping brow and intent mien is not the ideal Scientific American reader that we have seen in our mind's eye; but his furious activity has our fullest approval. He is the only man in the four pictures who seems to be up and doing.

Consul-General Samuel M. Taylor, of Callao, calls attention in the following report to the need of registering trade-marks in Peru:

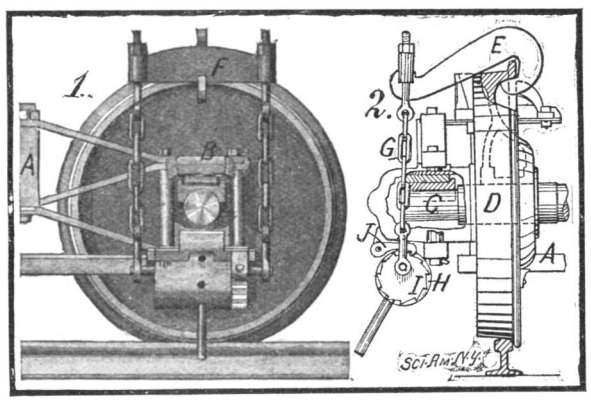
The Peruvian law permits the registration of any trade-mark or trade name not hitherto registered in Peru. The effect of this is that any person can register a mark or name that he has no proprietary interest in, to the exclusion of the real owner, provided he is first in making application. Having registered he may manufacture a spurious article under this mark or name, while the genuine article cannot be introduced at all; or he may compel the rightful owner to purchase his registered rights at an excessive price. Registration is an easy matter and should not be neglected.

In connection with the Austrian governmental establishment for the preparation of uranium products there has been built in Joachimsthal, Bohemia, a laboratory for working up radio-active substances found in the tailings and by-products of the uranium minerals. There will also be erected a bathing establishment, where the radio-active mine water will be used for healing purposes.

Patent Department

AN IMPROVED LIFTING JACK.

The device illustrated herewith is particularly adapted for lifting car trucks to permit the removal of journal bearings. The usual method of raising the journal box causes the wheel to rise also unless it is blocked to prevent this movement. The present invention obviates this difficulty by using the wheel as a

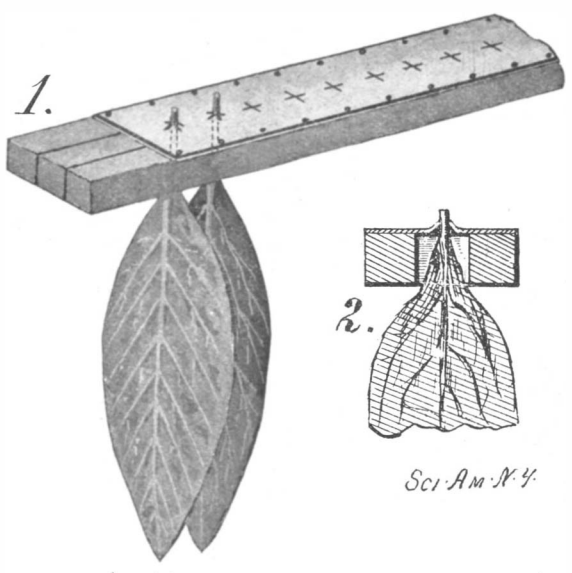


LIFTING JACK FOR CAR-WHEEL JOURNAL BOXES.

support on which the lifting jack operates. Hence, the wheel is firmly held to the track during the operation while the journal is lifted and the brass jammed therein is removed. In our illustration a portion of a truck frame is shown at *A*. This is provided with the usual journal box *B*, which rests upon the journal *C* of the wheel *D*. The usual brass is fitted between the upper part of the box *B* and the journal *C*. This, it will be understood, supports the weight and in order to remove it, it is necessary to raise the journal box from the journal. To effect this a hook, *E*, is provided which, at one end, hooks over the flange of the wheel and at the other end is provided with a notch in which the yoke bar *F* is fitted. In this yoke bar are a couple of eye bolts provided with chains *G*, which support the shaft of a cam or eccentric *H*. Between the cam and the lower part of the journal box a shoe is fitted. This carries a dog, *J*, adapted to engage the teeth of a ratchet, *I*. The cam is provided with peripheral openings, and by inserting a hand bar in these openings the cam may be rotated. The nuts on the eye bars provide the necessary adjustment so that when the cam is rotated the throw of the eccentric will lift the journal box with respect to the car wheel and permit the brass to be removed. In order to prevent the shoe which fits over the cam and under the journal box from slipping out when the cam is operated, latera' projections are provided on the shoe which extend behind the truck bolts, while at the forward end of the shoe there is an upwardly extending flange which bears against the forward face of the journal box. Mr. Emil H. Zum Berge, of 159 McKumey Avenue, Dallas, Texas, has recently secured a patent on this lifting jack.

TOBACCO HANGER.

The usual method of suspending tobacco in the curing shed or drying house is to string the leaves on twine. The objection to this method is that the twine will sag in the center so that the leaves hanging upon it will slide toward the center and running together cause a good deal of damage to the tobacco. To overcome this difficulty the tobacco hanger shown in the accompanying engraving has been invented. It consists of a pair of laths laid parallel to each other and spaced apart at the end and the center by means of spacing blocks. Over the top of the hanger thus

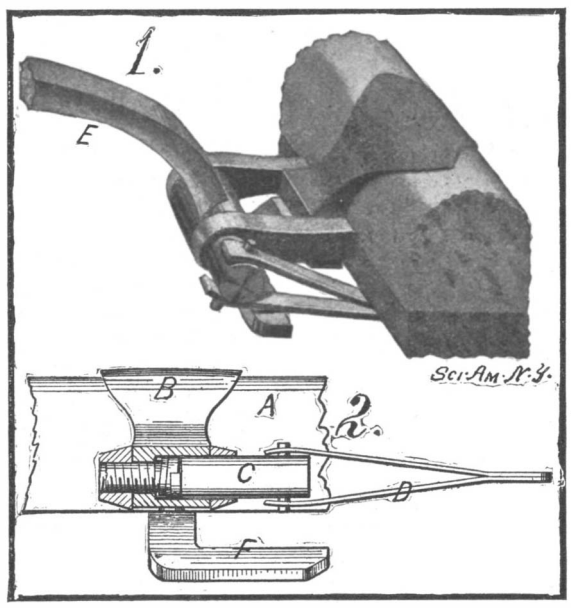


AN IMPROVED TOBACCO HANGER.

formed, a rubber plate or strip is secured. At regular intervals in its length this strip is slitted, there being two short slits which intersect each other at right angles to form a cross. The stems of the tobacco leaves are thrust up through the slits and gripped by the elastic action of the rubber strip so that they are held in the manner illustrated in the accompanying engraving. Whenever desired, the leaves may be withdrawn with comparative ease and without injury. Owing to the fact that the leaves may accurately be spaced on the hanger, more leaves may be hung in a specified space than with the old twine and needle method. This economizes on the labor in hanging the hangers in the drying room. Furthermore, there is an economy of time in fastening the leaves to the hangers. The inventor of this improved tobacco hanger is Mr. H. M. Lott, of Havana, Florida.

THILL COUPLING.

The purpose of the invention which is illustrated herewith is to provide a thill coupling of simple construction wherein a wrench or other tool is not needed in effecting the coupling or uncoupling of the shaft irons. The necessary operating tool is embodied in the mechanism as an integral part thereof. The forward axle of the vehicle is indicated at *A* in our engraving. This is provided with a clip *B*, and the latter is formed with two forwardly projecting arms between which the eye of the shaft iron *E* is fitted. These arms are provided with eyes to receive the draft bolt *C* which passes through the shaft iron. As shown in the cross sectional view, the eye in one of the arms of the clip is of larger diameter than that in the other arm and the eye of shaft iron is correspondingly reduced at one end. The draft bolt is also provided with two diameters, the reduced portion being threaded to engage the smaller eye and the reduced part of the eye in the shaft iron. A shoulder

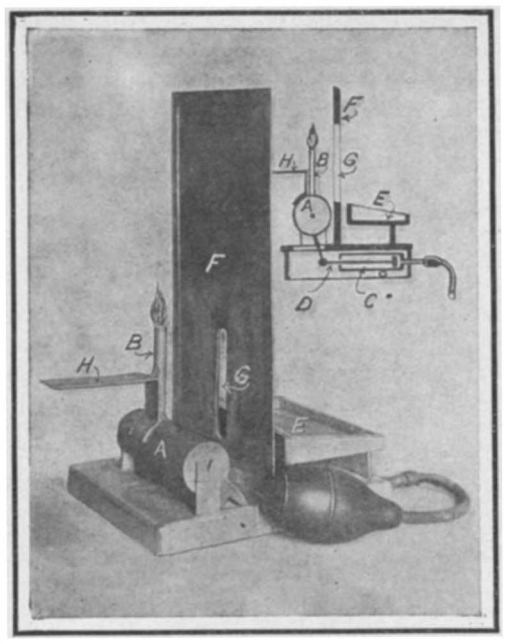


AN IMPROVED THILL COUPLING.

is formed between the reduced portion of the eye in the shaft iron and the enlarged portion thereof. Between the shoulder in the shaft iron and the shoulder on the draft bolt a coil spring is mounted. This serves to prevent rattling of the parts, and also takes up any lost motion that may occur. To operate the draft bolt a key, *D*, is provided. This is made of spring material and is bifurcated at one end. The members of the key at its bifurcated end are fitted over pins projecting from opposite sides of the bolt. After the bolt has been screwed up to its desired adjustment, the key is turned at right angles thereto and fitted between the shaft *A* and a projecting arm *F* on the locking plate of the clip *B*. When in this position it is practically impossible for the device to be shaken off under any condition of usage. Dr. Jacob S. Shoemaker, of New Lothrop, Mich., is the inventor of this new thill coupling.

REVOLVING FLASH LAMP.

Nothing can equal the ridiculous expressions of a flashlight group picture. No matter how instantaneous the flash, the plate is sure to record some comical facial contortion. Probably the reason for this is that the subjects have some warning of the coming flash and have time to unconsciously fix their expressions in expectation of the explosion. A flash lamp has just been invented which is so arranged that the photographer can ignite the flash powder instantly whenever he chooses and without the slightest warning to the subjects before the camera. This enables him to make an exposure at the most favorable moment. A photograph of the flash lamp is reproduced herewith and the mechanism is also shown diagrammatically. The lamp comprises a reservoir, *A*, for gasoline or alcohol. This is provided with a stem, *B*, in which a wick is inserted. The reservoir, *A*, is mounted to rock on its axis and is connected to a plunger, *D*, which works in a cylinder, *C*. The cylinder is fitted with a flexible tube which leads to a rubber bulb. When the bulb is compressed the lamp is rocked on its axis, swinging the wick against a pan, *E*. The flash powder is placed in this pan, and is thus ignited. A shield is placed be-

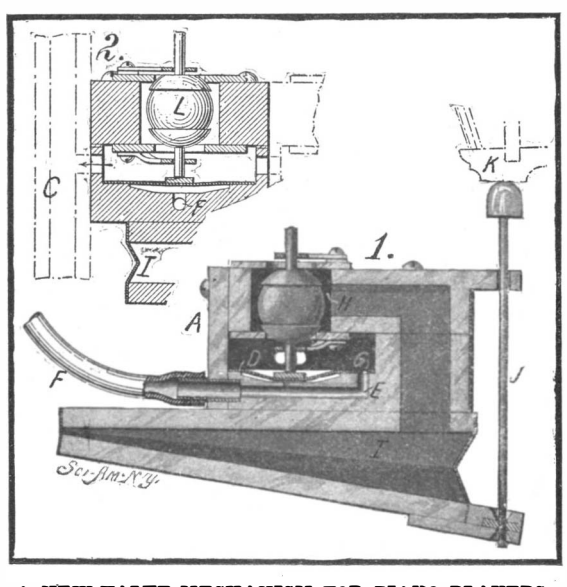


A REVOLVING FLASH LAMP.

tween the pan and the lamp. This is indicated at *F* and is provided with a slot, *G*, through which the wick stem *B* is adapted to pass. Projecting at right angles from the stem, *B*, is a plate, *H*, which serves to cover the slot, *G*, when the lamp is rotated to ignite the powder, thus protecting the operator from the flare of the flash powder. It will be noted that the powder is ignited at the top and burns downward, consuming all the powder in the pan. This prevents the danger of scattering the powder in all directions, as sometimes happens when the powder is ignited beneath the surface. The inventor of this improved flashlight is Mr. Ernest E. Adams, of 287 Fourth Avenue, New York.

PNEUMATIC VALVE MECHANISM FOR PIANO PLAYERS.

The accompanying engraving illustrates an improved pneumatic valve mechanism for automatic piano players and similar instruments, which is so arranged as to insure a quick response of the pneumatic and consequently of the piano action, and also to render the valve mechanism noiseless. Furthermore, the parts are so designed as to allow convenient access to the interior for making repairs whenever necessary. The valve chest of the mechanism is indicated at *A*, and is provided with a suction chamber *B* connected with a main suction chamber *C*. A diaphragm *D* is fitted across the lower end of chamber *B* and below the diaphragm is a chamber which communicates with a passageway *E*. The latter connects with a tube *F*, which opens in the tracker board of the instrument. This tracker board is not shown, but it will be understood that the music sheet travels over the board and when a perforation in this sheet registers with the duct *F*, air passes down therethrough into the diaphragm chamber, causing the diaphragm *D* to move upward owing to suction within chamber *B*. A small port *G* connects the passageway *E* with the suction chamber *B* so that as soon as the duct in the tracker board is closed the air will be exhausted from the diaphragm chamber and the diaphragm will drop to its normal position. In the upper wall of chamber *B* is a port communicating with a valve chamber *H*, which, in turn, connects with a pneumatic, *I*. A spherical valve, *L*, fitted with caps of leather or other soft material is arranged normally to close the port between chambers *B* and *H*, and at the same time to open a port in the upper part of chamber *H* so that

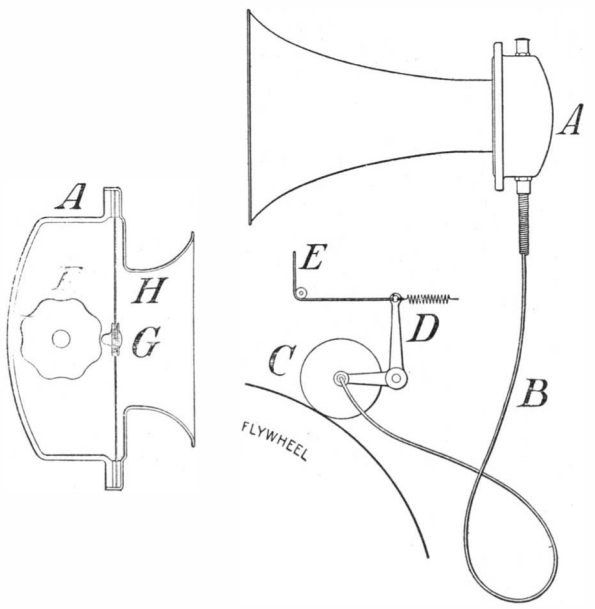


A NEW VALVE MECHANISM FOR PIANO PLAYERS.

the pneumatic, *I*, will communicate through the latter port with the outside air. When the diaphragm *D* is flexed upward, the upper port in chamber *H* is closed, and the air in the pneumatic *I* is sucked out through the lower port into the chambers *B* and *C*. This serves to collapse the pneumatic, raising the rod *J* and thereby operating the key *K* of the piano. The advantage of using a spherical valve, *L*, is that a quicker action is obtained with less danger of leakage, and the opening or closing of the valve is noiseless because the air rushing through the valve seats does not strike any sharp edges and hence produces no hissing sounds. The valve chest *A* is horizontally divided into two parts, fastened together at one side by a cloth hinge and sealed at the opposite side by a board which is held in place by means of screws. When it is desired to open the valve chest the rod *J* is removed and the board is unscrewed from the chest whereupon the upper part of the chest may be swung up to permit free access to all parts of the mechanism. The inventors of this valve mechanism are Messrs. Theodore Vrana and Bretislav Schiba, of 1506 Avenue A, New York, N. Y.

A NEW TYPE OF AUTOMOBILE HORN.

An automobile horn can hardly be classed as a musical instrument. Its office is not to produce a soothing tone, but to emit a sound so startling and ear-piercing as to excite immediate action on the part of pedestrians in the path of the car. This requirement of automobiles is responsible for a wonderful variety of sound producers. The latest contribution along this line is a small instrument, which produces a sound so entirely new that it is very difficult to describe it. When driven at low speed the sound resembles a growl or roar, but as the speed is increased, the sound ranges up to a shriek or yell, which is totally unlike and far more penetrating than the sound produced by a siren whistle. The accompanying illustrations show how this is produced. The instrument proper is indicated at *A*, and is operated by means of a flexible shaft *B*, connected to a friction wheel *C*, which bears on the flywheel of the engine.



INTERIOR DETAILS OF THE HORN.

DETAILS OF THE FRICTION DRIVE.

The tone is varied by pressing the wheel *C* more or less firmly against the flywheel. The friction disk *C* is mounted on one arm of a bell crank *D*, to the other arm of which a chain *E* is attached. This chain runs to the steering column of the car. Within the casing *A* is a cam wheel *F*, which is formed along its periphery with a series of swells. These cam swells are adapted to strike a small anvil mounted on a diaphragm *H*. In front of the diaphragm is a horn *G*, which may be of any suitable shape. In operation, when the chain *E* is pulled, the wheel *C* is brought into contact with the flywheel, and by means of the flexible shaft *B* the cam wheel *F* is set in motion. The latter vibrates the diaphragm violently by rapidly striking the anvil, and the piercing sound is thus produced. In addition to the construction here shown, the new horn is arranged to be operated by a small electric motor, directly connected to the cam. Furthermore, a hand-operated horn of this type is made, in which the cam is driven by a hand crank. This should be useful on boats, as the sound produced penetrates fog readily. The inventor is Mr. M. R. Hutchison, of 1 Madison Avenue, New York city.

A MACHINE FOR VENDING POSTAGE STAMPS.

From time to time we have described in these columns the progress made by countries other than our own in developing postage stamp vending machines. The United States has been slow to take up with this idea and yet, undoubtedly, mechanical stamp venders are as necessary in this country as anywhere else. The public is put to a great deal of inconvenience after the closing hour of the various post offices and branches in large cities, and the burden of selling stamps has been imposed upon hotels, drug stores, tobacco stands, etc. Recently our postal authorities have been examining various machines for automatically selling stamps and as an experiment have installed three such machines in the New York Post Office. These machines respectively sell one, two, and five-cent stamps. One of the difficulties we have to contend with, and which is peculiar to this country, is the fact that while the bulk of the sales made by machines of this character must necessarily be in two-cent stamps, we have no coin of this denomination in general use. Hence, the two-cent stamp machines must be so arranged that they will not deliver a stamp until two one-cent pieces have been inserted in the slot. Our illustration shows a two-cent stamp vending machine. The mechanism in this machine is very similar to that of the one and five-cent machines, except for a small detail that will presently be explained. All the machines are entirely automatic. They do not have to be "wound up," and there are no handles to be operated. One needs merely to insert the coin or coins, and the stamp issues from the stamp slot. It is impossible to insert a larger coin than the one called for, and if by accident or intentionally a smaller coin is inserted, it will automatically be rejected from the machine. Unless the coin is of the requisite weight, it will fail to operate the mechanism. In this way the usual precautions against fraud are provided.

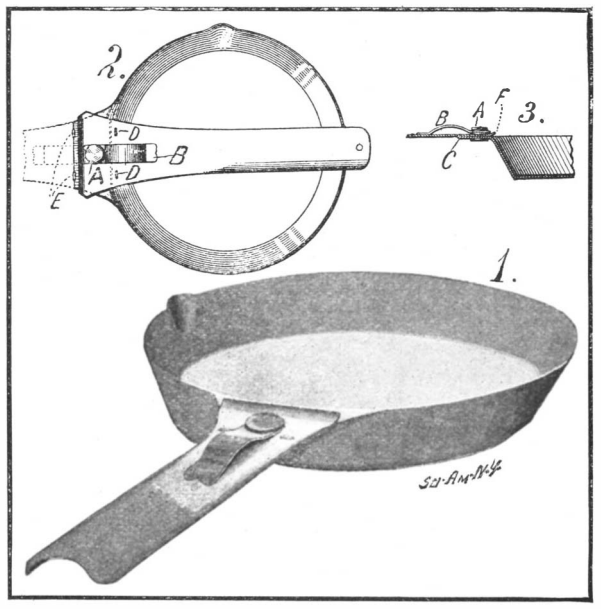
The stamps are arranged in a long strip, which is wound on a brass roller or core. The coil of stamps is placed in an inclined trough and the end of the strip passes over a drum to the stamp slot. The drum is formed with pins or teeth which engage the perforations between the stamps. When a coin is inserted in the slot, it lifts a weight at the top of the machine. This weight, acting through the medium of a ratchet mechanism, exerts a tension on the drum, but the latter is prevented from rotating by an escapement. The coin, after passing along a slide and dropping down a chute, strikes an arm of the escapement wheel, releasing the drum and permitting it to turn and project a stamp through the stamp slot. The stamp is not detached from the strip, but must be torn off. It projects through the slot at such an angle that it is impossible to pull out or tear off more than one stamp at a time. In the two-cent stamp machine the first coin merely raises the weight while the second coin operates the trip which releases the drum.

When the stamp strip has been uncoiled from the core, the latter rolls down the inclined trough and operates to expose a sign which will warn people that the machine has no more stamps to sell. By pasting a blank strip of paper to the end of the stamp strip the release of the core is delayed until the last stamp is sold.

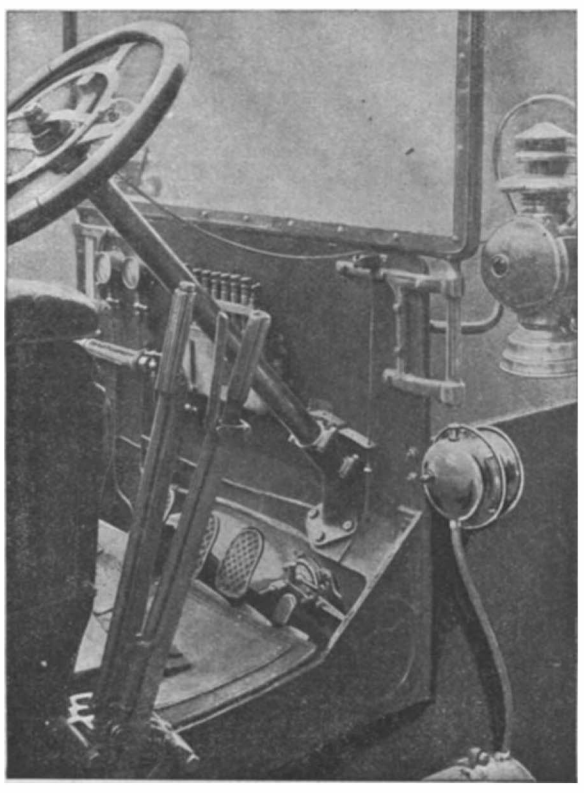
It is expected that this machine will be of service not only for selling stamps but for selling tickets on subway and elevated stations. The machine would not do away with the booths now in use, as these would be necessary for purchasers who had not the exact change. However, as adjuncts to the ticket sellers these machines would prove very valuable in busy hours, to accommodate the man with the right change.

FRYING PAN WITH FOLDING HANDLE.

A frying pan which should be particularly useful for campers, prospectors, and the like, has recently been invented by Messrs. Olaf Lenschow and Christian Mathieson, of 482 East Park Alley, Butte, Mont. The frying pan is so arranged that the handle may be swung across the pan when the pan is not in use, and when turned to an extended or operative position, it will automatically lock in place. The pan is formed with a short stub, to which the handle is attached. The handle is held to the stub by a pin or stud *A*, under which a spring *B* is fitted. The spring *B* serves to take up lost motion between the pan and handle, and prevent the parts from rattling. A pair of apertures *D* are formed in the handle, and at the end of the stub there are a pair of projections *E*. These are adapted to engage the apertures in the handle when the latter is turned to extended position. The inner end of the handle is curved up slightly, as shown at *F*, so that when the handle is turned across the pan, it will ride over the projections *E*. When it is desired to fold the pan, the handle is lifted sufficiently to clear the projections *E*, after which the handle may be turned to the position shown in Fig. 2. In this position the utensil may readily be packed away.

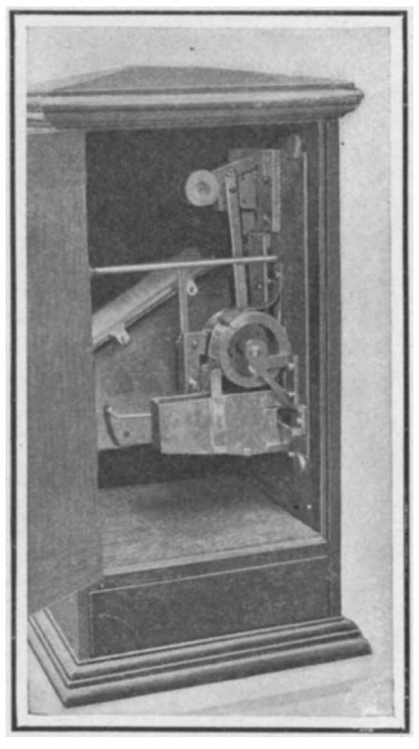


FRYING PAN WITH FOLDING HANDLE.



VIEW SHOWING THE NEW HORN IN PLACE ON AN AUTOMOBILE.

A MACHINE FOR SELLING POSTAGE STAMPS.



INTERIOR OF THE AUTOMATIC STAMP VENDER.

RECENTLY PATENTED INVENTIONS.

Electrical Devices.

ELECTROMAGNETIC MOTOR.—A. H. BEARD, Memphis, Tenn. The invention relates to a motor in which the application of magnetic force induced by electricity is applied in a most economical and efficient manner. The principal objects are to transform the energy due to electricity and magnetism into other forms of energy, and apply it to useful purposes in the most efficient and economical manner.

LIGHTNING-ARRESTER.—H. V. BASTIN, Lancaster, Ky. The arrester is designed to facilitate as much as practical the discharge or separation of high potential currents from the dynamic or useful current in electrical circuits, by a coil forming a part of the circuit and surrounded by a line cylinder and a ground cylinder, the latter located between the coil and line cylinder, each presenting a large number of points or edges whereby little resistance to currents of high potential in passing from both the coil and line cylinder to the ground, will be offered.

SAFETY DEVICE FOR ELECTRIC POINT SHIFTING, SIGNALING, LOCKING, AND SWITCHING APPARATUS.—L. KOTTMAIR, Munich, and R. ZWACK, Nordendorf, near Augsburg, Germany. If the point-shifting, or other shifting device is put into the position in which it is to be secured, it closes a circuit automatically and directly or by means of intermediate adjusting-devices, whereby shifting of safety switch is effected. During shifting the safety switch breaks the lead or leads of the point-shifting device or the like, by which a displacing of the latter into dangerous position might take place. Only when the safety-switch is shifted back into original position, which as a rule is effected by contact, the broken circuit is closed and the point-shifting device can again be shifted.

TROLLEY-CAR POLE ATTACHMENT.—G. R. DUNN, San Diego, Cal. It is requisite for the best results in actual use here that the wheel running in contact with the live wire overhead shall be held unyieldingly as to vibration in the direction it travels, and still more important that it shall be allowed freedom of vibration laterally, so as to follow the wire closely when passing around curves. Also important that the spring attachment employed for holding the wheel in due position while permitting lateral movement shall be arranged to be well protected from contact with other objects, thus avoiding injury, entanglement and friction.

TROLLEY.—F. E. BRAZEAL, Monson, Mass. Firstly, the inventor provides a trolley wheel which will be for extended periods properly and automatically lubricated; secondly, he so connects the wheel with the forked end of the pole that it may be easily and readily detached and replaced without the use of tools, as for adjustment, the renewal of parts, or for other purposes.

MEANS FOR SHOWING FROM A DISTANCE THE VARIATIONS IN TEMPERATURE.—J. B. FOURNIER, 62 Quai des Orfèvres, Paris, France. More particularly the invention refers to means which comprise a curved tube or hand-wheel the ends of which move away or approach each other by the effect of variations in the pressure within the same, the tube being connected to a tube of small diameter one end of which is closed and which is partly filled with a liquid volatile to a very small extent, while the part near the closed end contains a very volatile liquid as well as vapors of the same. Means cause the tube to expand or contract, and the motions actuate an indicating hand, or some other indicating means.

THERMOSTAT.—C. J. FOX, 11 Queen Street Place, London, England. The object of the inventor is to provide a thermostat adapted to be interposed in an electric circuit containing a visual or auditory alarm, whereby notice will be given when the electric circuit is closed by the thermostat on a predetermined temperature being attained. It is a division of the Letters Patent for an improvement in automatic fire-alarm systems formerly filed by Mr. Fox.

TROLLEY.—H. C. REYNOLDS, Portersville, Cal. One purpose of this invention is to provide a simple, economic, and reliable construction of trolley pole and head adapted especially for overhead work, and which will be self-adjustable since the two said parts will automatically so adjust themselves that the trolley head will stand almost horizontal on curves and overhead switches.

VIBRATOR.—A. G. GRAY, St. John, New Brunswick, Canada. The invention relates more particularly to a vibrator provided with electrical connections whereby the device may be employed for treating the body electrically, and at the same time giving mechanical vibrations thereto. More in detail, it involves a device adapted to be held in engagement with the body and having a sliding member by the movement of which vibrations are given to the device.

Of Interest to Farmers.

CORN-HUSKER.—F. A. INGERSOLL, New York, N. Y. It is sought in this improvement to provide a novel construction for removing husks from ears of corn. The diagonal arrangement of ribs is important, as it increases the opportunity of engaging with some projecting portion of the husk in order to pull it off the ear, as the latter travels along the rolls, the rolls of each pair turning toward each other in the operation. The point of angle at the meeting of the ribs of an adjoining series is important in starting the husk where it lies close to the ear, as in very dry corn. Ribs of the rollers of each pair mesh throughout the lengths of the rollers and aid the operation.

COTTON-CHOPPER.—W. MCCALEB, Bluffs, Ill. One purpose of the invention is to provide a chopper attachment to cultivators and planters, or machines in which the cultivator is combined with the planter, and to so construct the attachment that it will be automatically operated by the movement of the machine to which it is applied.

BEET-TOPPING MACHINE.—J. N. HANNA and D. K. WAUGH, Ordway, Col. An object in this invention is to provide an improved machine adapted to cut off the tops of sugar beets or any other root crop before removing the root portions from the ground. Another object is the provision of means for clearing the tops to one side after they have been cut off.

COTTON-CHOPPER.—D. S. BALLANCE, Wysocking, N. C. In the use of this machine the flaring inclination of the hoes has a tendency to not only chop the plants from the row, but also to remove them and the soil in which they are bedded to one side of the row and thus secure a better chopping out of the row in its practical service. Draft if needed may be applied by means of a rod arranged so that the horse or mule may move alongside the row of plants.

PLANTER.—W. B. HAMPTON, Fremont, Mo. The machine plants the exact number of grains in each hill while check-rowing regardless of size of grain. Dropping by gravitation, it plants accurately until the last grain is out of the seed boxes. This combination planter plants different kinds of seeds as accurately as that of corn and will check row or drill them together or separately, the change being made by slight move of a lever. The check row attachments are simple and work easy with but little strain and no friction on the wire. It plants and stretches wire and plants and takes it up at the same time, with no loss of time or labor.

WEED-CUTTER AND CULTIVATOR.—O. E. SLAYTON, Dillon, Oklahoma. In this patent the invention has reference to agricultural implements, and its object is to provide a new and improved weed cutter and cultivator, more especially designed for cutting weeds and cultivating corn and cotton in listed rows, in a very effective manner.

Of General Interest.

SAFETY-MATCH.—G. E. SCHULTZ, New York, N. Y. The purpose of the inventor is to overcome several objections prominent in the production of matches, and this is accomplished by the provision of a safety match with an ignition strip, mass or composition so placed that there will be no danger of accidental ignition and none of subjecting the igniting composition to wear.

BEER-CASE CURTAIN.—J. M. JETTER and F. DREWS, South Omaha, Neb. The curtain when applied to a case prevents transmission of light through the openings which serve as handles, and keeps out much cold in winter. The cases have covers or lids which prevent entrance of light from above, but when covers are not used, the light and cold air are prevented from entering the box by placing one box over the other, the top one being covered by any suitable material.

CAMP-STOOL.—E. HUEBNER and H. KLOSS, New York, N. Y. In the present patent the invention has for its object the provision of a camp stool simple in construction, effective in operation, durable in use, and perfectly adapted for the various parts to be folded closely and firmly together into a small compass so as to be readily carried by the user.

CHECK-FORM.—W. H. BERTRAM, Springfield, Mo. The object of the inventor is to provide an improved check form for protection in the use of bank and commercial paper such as drafts, checks, notes, etc. The improvement is embodied in a check form, which represents a plan view of a blank instrument filled out and directing the payment of a certain sum. Means provide for the bank or other payer ascertaining whether the instrument has been raised or changed.

TAG.—S. H. BROWN, Lockhart, Tex. The object of the invention is to provide a tag for indicating sizes, prices, and the like for dry goods and other material usually sold from rolls or bolts. The tag is adapted to be secured firmly to a bolt or roll by means of an adhesive, with a body upon which indicating characters are inscribed, arranged at the end of the roll or bolt.

FILTER.—I. BOYD, Eminence, Ky. This invention pertains more particularly to a filter adapted for use in connection with pumps or other general source of water supply; the object being to provide a construction whereby the filter may automatically drain and remain dry while not in use.

EYEGLASS-HOLDER.—MARY E. DRIPPS, Washington, D. C. The hook suspending device in this invention is adapted to hold an eyeglass with security and safety, yet is readily accessible and detachable for use whether the chain connected therewith be taken up into the casing by the spring therein, or left hanging free from the casing or other device attached to the clothing.

ELECTROLYTIC PRODUCTION OF PURE TIN.—A. J. M. THIROT, 83 Rue Bourbonnoux, Bourges, France. The process relates to the extraction of tin, in the form of pure metal, either from stanniferous slimes or from natural tin ores which have previously undergone a mechanical preparation, as energetic oxidizing roasting and lixiviation, or again from all products capable of yielding stannate of soda, by the wet or the igneous process, such as tin drosses, tin work waste or old tin plate.

MANUFACTURE OF CRATES.—W. C. YEOMANS, Pe Ell, Wash. The aim in this case is to provide improvements in the manufacture of crates, whereby the blank for forming the crate is woven flat in single piece, and the connected parts of the blank thus produced can be readily folded and closed to form a complete crate without requiring extra fastening devices.

DENTAL IMPRESSION-TRAY. — H. F. SMITH, Seattle, Wash. In making the tray hollow a false bottom of tin or other sheet metal may be soldered at its edges to the edges of the tray proper. Being hollow enables a current of air through tubes to cool the impression in the fraction of a minute. The guard plates are conveniently manipulated in handling the tray and operate efficiently in controlling the cheeks and preventing interference with the operation of taking an impression.

SHAVING-BRUSH.—S. SALOMAN, Washington, D. C. In place of the usual bristles, the brush is provided with a rubber-sponge latherer. The rubber sponge is formed with a shank fitted into a spring metal clamping cup and the latter is slit at one side and tapers outwardly so that when threaded into the handle it will compress and hold the rubber firmly in place.

POST.—J. H. DODDRIDGE, Vincennes, Ind. The fence post is constructed of cement, artificial stone or other like material, and is reinforced to effectively resist strains to which posts are subjected. The post also provides for the attaching of wires thereto by engaging the same in a sidewise direction, and the wires when so engaged are freely movable in the direction of their length, whereby they may be easily stretched and expand and contract.

CRAYON-HOLDER.—MARY M. GEE, Orange, N. J. The invention is an improvement in crayon holders or multiple rulers, for drawing upon a blackboard or other surface a series of parallel lines at a single stroke. The device is of peculiar value to music instructors for drawing the staff, and also to teachers and others generally who are required at times to draw a number of lines having exact parallelism.

ALARM.—H. IRWIN, Tikokino, New Zealand. The invention pertains to alarms for scaring birds and for other purposes, and its object is to provide an improved alarm, cheap to manufacture, and arranged to sound alarms by periodic explosions of fire crackers and like detonating devices.

Hardware.

SASH-FASTENER.—J. M. URICK, Ironton, Ohio. The fastener is adapted for application to the upper and lower sashes of a window, and affords means for detachably securing the two sashes together at a desired point of lowered adjustment for the upper sash, and will hold the lower sash stationary by such an adjustment of the device and also will hold both in closed condition when this is desired.

FENCE-WIRE FASTENER.—W. H. SULLIVAN, Fort Shaw, Mont. The object of the improvement primarily is to provide a fastener embodying both simplicity and strength, by which the wire may be easily and securely connected to the post, or be detached therefrom without injury to the parts, thus making it possible to use the fastener repeatedly.

NAIL PULLER AND STARTER.—B. F. LINDEMAN, McKees Rocks, Pa. The invention is an improvement in nail pullers and nail setters or starters and is especially adapted for use in connection with hammering tools, such as hammers proper and hatchets. It provides a starter as well as a puller and will be found especially useful in places such as corners and the like where it is only convenient to work with one hand.

CLEVIS.—L. K. MCCLELLAN, Billings, Mont. The clevis consists of a main bar with one end upturned and a bolt passing through an eye in the other end. A latch-bar is pivoted to the upturned end and is provided with an opening adapted to receive the free end of the bolt. The latter is formed with a shoulder which engages the latch-bar.

HARNESS-FITTING.—W. H. FERRIS, Sault Ste. Marie, Mich. One purpose of the improvement is to provide a form of harness tree and check hook, and a device for attaching the same to the tree in such manner that it leaves the inner surface perfectly smooth, and so that in the event of a broken hook it can be removed and replaced without damage to or the disturbance of the lining of the body.

DIVIDERS.—C. G. MOBERG, Keelerville, Saskatchewan, Canada. The object in this case, among others, is to provide a tool capable of accurately and automatically bisecting or otherwise dividing the distance between two points, thus making the tool of particular value for machinists, draftsmen, architects, etc.

HORSESHOE.—E. M. DUNN and W. H. FRANCIS, Fairhaven, Mass. The shoes, which are ordinary horseshoes, with the exception of certain notches, are nailed to the hoof. When the calks become dull or when desirable to put on sharp calks, the scissors plates of the facing are extended and the facing is applied to the outer face of the shoe, with the calks of the facing inside the shoe calks. Means provide for retaining or removing the facing.

FASTENER.—P. SICOTTE, Lansing, Kan. This fastener is particularly for use in joining different parts of furniture such as tables, chairs, dressers and the like. An object of the invention is to provide a strong fastener which takes the place of screws or hanger bolts and which can be applied or released with ease and rapidity. A further object is to provide a device by means of which the parts can be joined together and which firmly holds them against relative movement.

Household Utilities.

SHELF.—G. W. CURTIS, New Britain, Conn. The invention relates to shelves, more particularly to that class adapted to be secured at window frames to carry potted plants and the like. An object is to provide a simple and durable shelf, which can be removably mounted at the frame of a window and which is adapted to fit windows of different sizes. The shelf comprises carrying members adapted to be removably attached to windows, and extensible shelves or pans removably arranged upon said members.

WATER-HEATER.—A. SHATSKY, New York, N. Y. The aim in this invention is to provide a device by means of which water running through the same will be quickly heated, thus making the device particularly useful in bath rooms and kitchens, and in all conditions where it is desired to quickly convert cold running water into hot.

COOKING VESSEL.—F. NESTOR, Elkins, W. Va. The object here is to prevent cooking vessels from boiling dry, at least within reasonable time. This is accomplished by providing a connection with the vessel, a tank superimposed thereon with automatic means, preferably float-controlled, for admitting the liquid from the tank to the vessel when the level of the liquid in the latter sinks below a predetermined point, whereby a certain height of liquid in the pot is maintained.

PRESERVING-JAR.—A. WILKIN, New York, N. Y. The intention of the inventor is the elimination of defects in a jar as ordinarily used, among which are the use of rubber for valves and gaskets, which furnish nesting places for the propagation of germs; the lack of any provision for the escape of air or gases from the jar during canning; the likelihood of air bacteria finding access to the jar and the difficulty of removing the cap when the jar is sealed.

Machines and Mechanical Devices.

COAL-AUGER.—M. MARTIN, Gilmore, Md. Since the bit is hollow, a core of coal is produced within a ring as the bit advances, and to break up this core a plate is provided and attached to the inner surface of a holder by means of screws, and one outer corner of the plate is turned at nearly a right angle to the latter, and the edges of the corner are sharpened to form cutting edges. The edge acts upon the core, breaking the latter into small pieces and assisting to feed it outwardly through a hollow pipe.

MACHINE FOR SOLING FOOTWEAR.—J. LARSEN, Silkegade 13, Copenhagen, Denmark. The essential in this machine consists in the press-pedal and the movement of this. While the feeding device, after the stitch is made and before the next is started, is moving the shoe, the pedal must only exercise a slight pressure on the shoe, and this by a pawl, fixed on an arm actuated from the shaft, pressing the ratchet-piece downward by overcoming the pressure of a powerful spring. The pedal is now only exposed to a weak spring pressure, and pressure on the shoe is now so light that the transporter moves with ease.

FRICTION-PULLEY. — H. H. BALLIET, Coplay, Pa. Primarily the object of the inventor is to provide means operable during the revolution of the pulley and shaft which carries it, for adjusting the mechanism to increase or decrease the frictional engagement with the pulley, whereby it is unnecessary to stop the line shaft for this purpose.

FLYING-MACHINE.—T. J. WHALEN, Middlebrook, Va. This invention is in the nature of a flying machine, and it consists in the novel construction and arrangements of the body frame, propelling devices, and steering devices. Bottoms of overhanging chambers are made of glass for observation purposes to permit looking toward the earth without risk; the chambers also form storage compartments for ballast, provisions, etc.; means protect the glass from breakage on landing; access to the interior of the car is by a door at the rear and deeper end of the car. These are some of the advantages.

POWER-HAMMER FRAME.—L. J. CLOSSEY, Montpelier, Vt. To meet the requirements of the invention, various novel adjustments of the

hammer and its position relatively to the supporting track and main frame are provided, whereby the hammer supporting arm may be swung around in an arc of a circle by means of a vertical shaft from which the hammer is supported, and it may be moved toward and from the vertical shaft. A further adjustment as regards the vertical position of the hammer is provided for.

PUMP.—M. Latta, Valentine, Neb. The pump is designed for use in drilling wells and other purposes. Speeded up to a certain degree, the valves will operate to close the ends of the tubes and hold the water back. When this speed is exceeded the centrifugal force operating upon the water opens the valve for its discharge, the valve holding it until sufficient pressure has been created to entirely fill the outer ends of the tube and thus prevent any entrance of air during operation.

GUIDE FOR MOLDING-MACHINES.—W. L. G. Williams, Paget, Clermont, Bermuda. The object of this wood-working machine is to provide a guide arranged to permit of taking very small cuts at a time, especially when cutting fine woods or cross-grained material, and to allow of using a single cutter head for making different shaped moldings.

MACHINE FOR RESHAPING BOTTLE-CAPS.—G. G. Glenn, Gastonia, N. C. The aim of the inventor is to provide a simple and practical machine for repairing previously used metal caps for bottles by reshaping them and at the same time inserting new cork disks therein. Mounting the swaging die and the cork-inserting plunger on the cross head on opposite sides of the vertical reciprocating stem, so that both enter the seats in the subjacent turntable at the same time for double action, is an important feature.

FLYING-MACHINE.—E. R. Ernst, Warrenpoint, N. J. The object of Mr. Ernst is to produce a machine driven by mechanism having a special construction adapted to balance the forces of the motor for the driving mechanism, so that the operation of the motor will not tend to throw the flying machine out of equilibrium.

METHOD FOR FORMING WOVEN PILE FABRICS.—J. K. Dalkranian, New York, N. Y. The intention in this case is to provide a method for forming woven pile fabrics of the tufted pile rug type, woven in any desired design and color, the weave having Persian knots and being preferably produced on a loom, such, for instance, as shown and described in the application for Letters Patent of the U. S., formerly filed by Mr. Dalkranian.

YARN-SELECTING MECHANISM FOR TUFTED-FABRIC LOOMS.—J. K. Dalkranian, New York, N. Y. This invention relates to looms for weaving Axminster and other carpets, oriental rugs, and like fabrics, and its object is to provide a yarn-selecting mechanism arranged to bring any desired colored yarns into position to be used as pile threads for producing a pile face of any desired and premeditated pattern.

PULLEY-CLUTCH BUSHING.—J. W. McGregor and L. G. Ferris, Tacoma, Wash. The intention in this instance is to provide a clutch which will catch in either direction and consequently cannot be placed wrong upon a shaft, and which will effectively prevent any slip between the shaft and the pulley, since a roller wedge is used which tightens as the load increases.

Musical Devices.

PNEUMATIC ACTION.—H. Meyer, New York, N. Y. The object of the inventor is to provide an action arranged to insure in self-players, self-playing pianos and like instruments, a quick response of the pneumatic whenever a tracker board opening is uncovered or covered up by the note sheet, to reduce undue fluttering of the diaphragm, and to allow convenient access for adjusting the working parts to a nicety.

LOCK-SLIP FOR AUTOMATIC PIANOS.—R. K. Thumler, New York, N. Y. The invention refers to lock slips, and employed to protect and conceal the expression levers, which lock slips have heretofore been attached to the keyboard to drop down therefrom, and consequently have been more or less unsightly as well as being in the way of the person operating the expression levers.

AUTOMATIC PIANO-PLAYER TREADLE.—F. W. Wright and P. H. Commerford, Binghamton, N. Y. In the present patent the invention is an improvement in the class of foldable bellows-operating treadle attachments for self-playing pianos, also for organs or melodeons. Means provide for holding the bellows so that the material composing its sides is not liable to crack as when folded or creased.

Prime Movers and Their Accessories.

ROTARY ENGINE.—C. O. Sherman, Rutland, Vt. One of the objects of this invention is to provide an efficient rotary engine having means for adjusting the inlet opening for the actuating fluid, whereby the quantity of fluid admitted to the engine at each revolution can be regulated. It relates more particularly to that class adapted to be actuated by steam, gas under pressure, or other suitable fluid media.

GASOLINE ENGINE AND PUMP DRAIN.—G. G. Forester, Bagley, Iowa. Mr. Forester's invention is an improvement in gasoline engine and pump drains. When the pump is in motion the rotation of the shaft tends to move the weighted levers outwardly, owing to centrifugal force. When this force attains a certain point, the movement of the levers moves a sleeve to bring the disk into contact with the angular portion of the link, whereby to move the latter downward, and to rotate the disk valve. At rest, and the drainage valve open, the check valve is also open and the check valve within the cooling tank will be closed, since certain links will both be moved in the direction of the engine cylinder.

ROTARY ENGINE.—H. C. Schaefer, El Paso, Texas. Primarily this invention has in view the provision of an engine in which undue friction and wear between the cylinder and piston will be avoided, whereby the efficiency of the engine is augmented, and also to provide for the equalization of the fluid pressure at each end of the piston blade, and to prevent the inward movement thereof under pressure when moving under the action of the motive fluid.

ROTARY ENGINE.—A. E. Abbott, Rhyolite, Nev. In this patent the aim of the inventor is to provide a new and improved rotary engine which is simple and durable in construction, very effective in operation, easily and quickly reversed by a simple valve arrangement, and arranged to utilize the motive agent to the fullest advantage.

Pertaining to Recreation.

PUZZLE DEVICE.—R. Haldenwang, Jr., New York, N. Y. The puzzle is of that character in which movable objects are placed in proper position by shaking their inclosure. The body portion of any animal, figure, or design is fixedly produced upon an elevated support beneath a transparent panel and wherein the dismembered parts are provided at their joints with flaps so placed that they can be made to enter openings made in the support at various portions of the figure body from which the parts were removed, the same lying at such parts flat with the plane of support. Other times the dismembered parts have a slanting position on the support and slide thereon.

Pertaining to Vehicles.

WHEEL-HUB.—R. L. Wilson, Salina, Kan. An object of the invention is to provide a hub which is dust and oil-proof, by means of which the wheel can be securely mounted upon the axle spindle without danger of accidentally running the wheel off the spindle, and which permits the wheel to be removed when desired, easily and rapidly.

LANTERN-HOLDER.—C. W. Leaning, Yankton, S. D. One of the objects of this improvement is to provide a holder having efficient means for resiliently supporting a lantern, and adapted to be removably mounted upon a vehicle body, the holder being adjustable laterally and vertically to enable the lantern to be held in the most advantageous position according to circumstances.

DEVICE FOR AUTOMATICALLY CONTROLLING LAMPS ON VEHICLES.—J. W. P. Smithwick, La Grange, N. C. The purpose of the invention is to provide automatic means for controlling the lamps on automobiles or other wheeled vehicles, which will turn the lamps, so as to constantly throw their light in the direction of progressive movement had by the vehicle, and thus illuminate the roadway in front of the same.

NECK-YOKE FASTENING.—W. W. Long, Coulee City, Wash. In the present patent the invention is an improvement in devices for securing neck yokes on the ends of poles of vehicles, such as buggies or wagons. The construction is simple, can be easily applied to new work, or to poles already in use and will be found very efficient for the purpose for which it is designed.

Designs.

DESIGN FOR A DISPLAY-RACK.—J. A. Larson, Hayfield, Minn. This design includes a rack, or support, for the same which has an extensible rod fitted in a cross bar base. The top of the rod holds six slim and graceful projecting and slanting arms for holding articles for display.

DESIGN FOR A BOTTLE.—C. W. Jones, Louisville, Ky. The design comprises a bottle with a screw top, a slightly protruding base, and an ornamental body form or configuration expressed by sloping lines and panel effect. The excess of diameter is below the middle. Two breaks in the vertical lines intersect the bottle at and below its center.

DESIGN FOR A CAP.—M. Mattes, New York, N. Y. The design represents a boy's cap of an automobile type. The peak and ornamental piece in front is of glazed material, the latter made to simulate the form and appearance of a chauffeur's goggles.

DESIGN FOR A BOTTLE.—P. Garrett, Norfolk, Va. In this ornamental design for a bottle, the body thereof is formed with broad side panels curved at their upper ends which alternate with narrower panels at the four corners of the bottle, and the corner and side panels merge at their upper ends in a tapered neck, having ornamental features at its upper end.

NOTE.—Copies of any of these patents will be furnished by Munn & Co. for ten cents each. Please state the name of the patentee, title of the invention, and date of this paper.

HINTS TO CORRESPONDENTS.

Names and Address must accompany all letters or no attention will be paid thereto. This is for our information and not for publication.

References to former articles or answers should give date of paper and page or number of question.

Inquiries not answered in reasonable time should be repeated; correspondents will bear in mind that some answers require not a little research, and, though we endeavor to reply to all either by letter or in this department, each must take his turn.

Buyers wishing to purchase any article not advertised in our columns will be furnished with addresses of houses manufacturing or carrying the same.

Special Written Information on matters of personal rather than general interest cannot be expected without remuneration.

Scientific American Supplements referred to may be had at the office. Price 10 cents each.

Books referred to promptly supplied on receipt of price.

Minerals sent for examination should be distinctly marked or labeled.

By some mischance, such as occasionally happens in a printing office, the answer to Query 10698 was incomplete. The statement should be added: "For distances up to 100 to 200 feet the fall of two such balls will not be different, but above this distance the resistance of the air will cause the balls to begin to separate." With this added, practical accuracy is secured, although some would doubtless stand out for a theoretical point that if the balls ever separate, they must begin to separate at the very first, before the eye could see that they were separating. We are content with a practical answer to the question. For a discussion of the question see Ency. Brit., vol. 11, page 66, sec. 2, by Sir Robert Ball, then Astronomer Royal of Ireland. It may be added that the resistance of the air upon the two balls varies as the square of the velocity. The aluminium ball is about 2,200 times and the lead ball about 8,750 times as heavy as air, hence both are able to overcome the resistance of the air very easily at first, and for this reason for limited distances they will fall with practically the same velocity. Wood's Mechanics, page 33, has this statement: "The velocities of heavy bodies falling 100 to 200 feet do not differ much from each other, and for compact masses of such materials falling in air we use 32 1/6 feet for gravity." That is, the full velocity of free fall is taken for distances up to 100 to 200 feet in air. This is what our first statement was intended to imply. We thank our friends who have written us about this query, and are glad to know that they are interested in the accuracy of the query column.

(10723) S. A. B. says: I am using large quantities of soft zinc from which I make small stampings, leaving about 30 per cent that I am obliged to put into scrap. This scrap is worth to me 4 cents a pound, whereas the new material costs me 12 cents. My idea would be to melt down this scrap that I have and reroll, but in trying this I find that the metal becomes so hard that it breaks in rolling. I presume that during the process of melting, one or more of the component parts passes off in the form of a gas, or perhaps my appliance for melting is not what it should be. I am familiar with the melting of copper and with the various alloys of brass, but this matter of remelting zinc and putting it in shape to stamp properly is something I am unfamiliar with. A. Melt the zinc at the least possible temperature, and pour into heated iron molds so that the cooling shall proceed very slowly. Avoid introducing any iron accidentally into the zinc during the melting, as iron causes brittleness. Adding 0.5 per cent lead makes the zinc more malleable. It should be rolled out at a temperature of 150 deg. C. to 200 deg. C., at which zinc is most malleable; at temperatures much above or below these limits, the zinc becomes too brittle to roll.

(10724) P. D. asks: A says that the mechanical advantage of a movable pulley is due to the fact that it is a second-class lever. B says that the mechanical advantage is in the rope. A. The movable pulley is a second-class lever and the source of power. The rope is only the medium of its application. A is correct.

(10725) M. F. wishes to know the best chemical used to purify acetylene gas. A. First wash with water to remove ammonia. To remove the other impurities, chiefly compounds of phosphorus and of sulphur, the following chemicals have been used: 1. Chloride of lime; unless all ammonia has been removed, nitrogen chloride may form. 2. Solution of cuprous chloride; one liter of this solution will purify 14 to 16 cubic meters of gas. 3. Solution of chromic acid in sulphuric acid; 5½ grammes of chromic acid will purify 1 cubic meter of gas. 4. Paraffin oil or other hydrocarbon oils. Solutions 2 and 3 give the best results. 4, used in conjunction with 2 or 3, increases the certainty of the purification.

(10726) H. C. F. asks: Can you give me any information as to the mixture used in binding coal screenings together that are made into briquettes? A. The best material for binding coal dust into briquettes, and the one most largely used, is pitch. Asphalt has had a limited use. Starch paste, residues from starch manufacture, dextrine, molasses, etc., have been used from time to time experimentally, but are not practicable. Various mineral substances, such as clays, lime, water-glass, etc., have also been proposed, but naturally have the drawback of adding just so much ash. Occasionally, oxidizing materials, such as niter, are added, when it is desired to produce a very quickly burning briquette for the rapid generation of high temperatures.

(10727) S. R. M. asks for a good receipt for making a reliable fire extinguisher in powder form, one that is easy to prepare. A. For a cheap, dry powder fire extinguisher, bicarbonate of soda will serve; it may advantageously be mixed with 5 per cent to 10 per cent of some powdered mineral, as flint, tripoli, chalk, etc., to prevent caking in damp air. A mixture of *dry* bicarbonate of soda with *dry* sal-ammoniac, and kept in a *dry* place, will do better, as it would yield both carbonic acid and ammonia.

(10728) W. R. W. asks what the different gases are which, if introduced into an inclosed arc lamp will turn the color red, green, yellow, blue, etc. A. Colored electric lights are ordinarly produced by coating the globe with an aniline dye, made in alcoholic solution, and mixed with a little varnish. We do not know any gas which could withstand the heat of the arc for any time and which could color the arc. Some color can be imparted to the arc by soaking the carbons in solutions of sodium chloride, strontium chloride, or lithium chloride, and drying them thoroughly before using. The light of the arc itself is so intense that it is very difficult to overcome it with any other colored light.

(10729) L. G. W. asks: 1. What is the most economical method of generating carbonic acid gas—not necessarily pure—in large quantities? A. The commercial sources of carbonic acid, on a manufacturing scale, are as follows: 1. By the burning of limestone. 2. By the action of acids in limestone (calcium carbonate), magnesite (magnesium carbonate), or dolomite (calcium magnesium carbonate). The acid used is sulphuric. This method is used by the manufacturers of bottled effervescing waters. 3. By collecting the carbonic acid gas generated in the fermentation vats of large breweries. This source is largely used in Germany. In addition, the gas coming from many of the natural springs is collected. This practice is also largely used in Germany. 2. Are there any known chemicals, or other substances, that will decompose water, aside from the alkaline metals? A. Besides the alkaline metals, water is decomposed by many of the hydrides and carbides of the different metals. Thus calcium carbides decompose water with the formation of lime and acetylene. Also, vapor of water passed through red-hot tubes of different metals is decomposed into its constituents. Vapor of water passed through red-hot coal is decomposed, with formation of carbon monoxide and dioxide, hydrogen, marsh gas (CH_4) and other hydrocarbons; this is the basis of the industrial manufacture of water gas, which has displaced coal gas in most cities.

(10730) J. N. D. asks for a formula for bluing iron and steel without heating. A. 1. From our Cyclopedia of Receipts, Notes and Queries, price $5: Scour the steel with a small quantity of a strong aqueous solution of soda, rinse in ¼ of an ounce chloride of iron, dissolved in 5 ounces of water, and let it dry; then apply in the same manner a solution of 1-5 of an ounce pyrogallic acid in 1 ounce of water, dry, and brush. Does not wear well without lacquering. 2. The blue oxide is sometimes imitated by using a thin alcoholic shellac varnish, colored with aniline blue or Prussian blue. 3. To blue steel without heat, mix finely-powdered Prussian blue with rather thin shellac; gently heat the steel and apply the varnish. 4. Iron and Steel to Blue Without Heat—Solution of potassium ferricyanide and water, 1:200; solution of ferric chloride, 1:200. Mix the two solutions and dip. 5. Antimony trichloride, 25 parts; nitric acid, fuming, 25 parts; and hydrochloric acid, 50 parts. Apply with a rag and rub until the proper color is obtained with a piece of green oak.

(10731) S. J. S. asks for directions for making rubber stamp pads. A. Boil 35 parts of Japanese (tien-tian) gelatin in 3,000 parts of water until completely dissolved. Strain, while boiling hot, through flannel, add 600 parts glycerine, return to the fire, and evaporate to 1,000 parts. With this liquid as a basis, make the ink of the color desired, using 60 parts of methyl-violet (3 B) for violet, 80 parts eosin (B B N) for red, 80 parts of phenol blue for blue, 50 parts anilin green for green, and 100 parts of nigrosin for black. With this ink saturate the cushion of the pad box and cover with mull. If at any time the surface becomes too dry, moisten with water or glycerine. The same author gives the following formula for glycerine stamp ink: Aniline water-blue 1 B, 3 drachms; distilled water, 10 drachms; acetic acid, 2 drachms; alcohol, 1½ ounces. Glycerine enough to make 10 ounces. Make a solution by rubbing in a mortar. In the same way inks of the following colors may be prepared with the above compound menstruum, substituting of course the pigment named for the aniline water-blue in the formula given: Violet, methyl-violet (3 B), 2 drachms; red, diamond fuchsin (I), 2 drachms; green, aniline green (D), 4 drachms; brown, vesuvin (B), 5 drachms; black, deep black (E), 3 drachms. For bright red omit the acid from the solution, replacing it by water, and using three drachms of eosin (B B N).

NEW BOOKS, ETC.

WORLDS IN THE MAKING. By Svante Arrhenius. Translated by Dr. H. Borns. Illustrated. New York: Harper & Brothers, 1908. 12mo.; pp. 230. Price, $1.60 net.

The German edition of Prof. Arrhenius's remarkable book, published under the title "Das Werden der Welten" has already been noticed in these columns. That an English translation should eventually appear was a foregone conclusion; for the book stands unique in modern scientific literature, inasmuch as it enunciates clearly and decisively a new and noteworthy cosmogony based on modern physical and chemical discoveries. By far the most startling and original chapters in the book are those dealing with the astronomical consequences of radiation pressure and with nebular evolution. In radiation pressure Arrhenius finds a plausible explanation for the puzzling phenomena of the corona, comets' tails, meteorites, and auroræ, and even the distribution of life in the universe. A new nebular hypothesis is set forth, an hypothesis which regards nebulæ as the result of the collision of dark suns, and therefore both as the beginning and end of stellar evolution. The translation seems faithful and fairly idiomatic in its English.

THERAPEUTICS OF VIBRATION. The Healing of the Sick an Exact Science. By William Lawrence Woodruff, M.D. Los Angeles, Cal.: J. F. Elwell Publishing Company. 16mo.; cloth; 144 pages. Price, $1.50.

Founded upon the electronic theory of matter, Dr. Woodruff's ideas contain many points of interest. He accounts for differences in the effect of drugs by the relative differences in the number of negative electrons, for he considers that life, due to cell-vibration, is directly dependent upon electronic forces.

DISEASES OF A GASOLINE AUTOMOBILE AND HOW TO CURE THEM. By A. L. Dyke. St. Louis: Phœnix Auto Supply Company. 1908. 12mo.; 217 pages; numerous diagrams. Price, $1.

The new edition of this useful handbook will be welcomed by all who are about to begin their automobile education. It contains a great deal of useful information for all those who have to do with gasoline engines of any kind, while there are many useful hints especially for the automobilist. The book goes into the construction and operation of the simplest form of gasoline engine, and also contains full instructions regarding the make-and-break and jump-spark ignition, batteries, magnetos, and other forms of recent ignition apparatus. Carbureters, transmission gears, lubrication devices, and the like are some of the things dealt with in considerable detail. The diagnosis of the troubles liable to be encountered, and the instructions for curing them, are complete and thorough. We can recommend this work to all who wish a handy guide to aid them in running their motors.

THOMAS ALVA EDISON. Sixty Years of an Inventor's Life. By Francis Arthur Jones. With numerous illustrations from photographs. New York: Thomas Y. Crowell & Co. 8vo.; cloth; 361 pages. Price, $2.

No attempt whatever has been made in this book at any critical estimate of the value of Mr. Edison's inventive work, largely because Mr. Jones is manifestly not a trained scientist or engineer. Apart from the fact that praise is ladled out with true journalistic fullness, the book is certainly an interesting review of Mr. Edison's wonderfully active career. When one reads the life of Edison by Francis Arthur Jones, one is struck by the early age at which the inventor became a factor in the mechanical progress of the world. His grasp of the problems of life, indeed, was remarkable at fifteen, at which period of his life he was the editor and printer of a local newspaper. To be sure, this journal was not large, nor was it perfect from either the literary or the typographical standpoint, but produced in a box-car on a moving train, as it was, it was even at that time considered an indication of future attainments. Following his natural fondness for electricity, Edison became a telegraph operator, at which vocation he developed the highest proficiency. This pursuit, however, interfered too much with his experimenting, so he cast about for some occupation that would be less exacting. This he found in the office of the "Law Gold Indicator," to which concern he sold his first profitable invention. The price received for this device, $40,000, enabled him to fulfill his long-cherished plan of devoting all his time to his investigations, and was, perhaps, the material parent of all his later discoveries. The best known of Edison's inventions are the incandescent electric light, the phonograph, and the kinetoscope. In addition to these, however, there is a host of others, less sensational, it is true, but quite as able to excite wonder in an appreciative mind.

A HANDBOOK OF WIRELESS TELEGRAPHY. Its Theory and Practice. By James Erskine Murray, D.Sc. New York: D. Van Nostrand Company, 1907. Cloth; 5½x8½ inches; 318 pages, xi tables, 131 figures. Price, $3.50.

A hand-book for students of wireless telegraphy who are already somewhat familiar with the principles involved. It is not a popular treatise, but a practical guide to this important department of science. Few, if any, quotations are made that do not bear directly on wireless telegraphy. Those inserted are given fully. The descriptions of apparatus and of measuring devices are complete in theory and in detail.

PRACTICAL PHYSICS AND LABORATORY MANUAL FOR COLLEGES AND SCHOOLS. By W. S. Franklin, C. M. Crawford, and Barry Macnutt. New York: Macmillan Company, 1908. Vol. I. Precise Measurements, Measurements in Mechanics and Heat. 170 pages; cloth; 6x8½ inches; 75 figures. Price, $1.25. Vol. II. Elementary and Advanced Measurements in Electricity and Magnetism. Cloth; 157 pages; 6x8½ inches; 146 figures. Price, $1.25.

The ground covered by these two textbooks in the form of characteristic experiments has been gone over very frequently by other writers. Their novelty rests in clearness of presentation, and in the judiciousness with which the various experiments appearing in them have been selected. In books of this kind, it is very hard to keep a middle course; they are either so simple as to offend the intellects of advanced students, or so technical as to be of service only to masters of the subjects they try to teach. In the first volume, the more serviceable branches of physics are illustrated by characteristic experiments. There is for instance a portion devoted to the measurement of length, of angle, of mass, and of time—the fundamentals of every exact determination. There are also experiments in mechanics, such as methods of determining the slide modulus by torsion. Under Heat, the theory and practice of standardizing mercury-in-glass thermometers is taken up. The general treatment is entirely satisfactory and does not insult the student by puerile suggestions. Volume II commences with a short description of some of the most commonly used instruments in electrical measurements, and from that goes on to statements of how to determine the efficiency of electric motors, how to standardize galvanometers, and so forth. The potentiometer is taken up, and the governing principle described. The book ends with a short dissertation on determining radio-activity, and shows the method and instrument perfected by Rutherford and others.

MODERN CARPENTRY AND BUILDING. With a Collection of Half-Tone Views of Fine Modern Residences. By W. A. Sylvester. New York; David Williams Company. Second edition, enlarged. 276 pages. Price, $1.50.

Some time ago the Modern Carpenters' Companion and Builders' Guide was issued. Although it received very little advertising, it met with a sale of some ten thousand copies. This indeed shows that it met a want. Complaints were made, however, that the illustrations were not always well placed with reference to the text matter, and many have expressed a desire for a larger number of plans brought up to date, together with elevations and perspectives to show the style of exterior finish. The book therefore was remodeled and added to, to meet these requirements, and it is distinguished from the former volume by the title "Modern Carpentry and Building." It is impossible in a small space to have all the principles of carpentry extensively dealt with, so this book can only be considered as an aid to the workman in the numerous questions that are constantly occurring, either where some detail has slipped his mind in one of the methods of laying out work, or as a source of suggestions on how to do kinds of work with which he may not have had experience. Elevations, floor plans, and complete framing plans have been inserted, giving exhaustive details of a modern three-story house of the latest design and construction. The complete specification and contract for the erection of a moderate-priced dwelling accompany these plans.

WATERWORKS DISTRIBUTION. A Practical Guide to the Laying Out of Systems of Distributing Mains for the Supply of Water to Cities and Towns. By J. A. McPherson. New York: Van Nostrand Company. Second edition, revised and enlarged. Price, $2.50.

An intensely practical textbook on the distribution of water-works by an experienced and well-qualified engineer. That it has already run through one edition speaks for its recognized usefulness.

PRACTICAL FARMING. A Plain Book on Treatment of the Soil and Crop Production. Especially Designed for the Every-day Use of Farmers and Agricultural Students. By W. Massey. New York: The Outing Company. Price, $1.50.

The plain straightforward treatise on farming is a rare thing nowadays. So much scientific progress has been made in the art that we have nothing but tomes on "Agronomy," treatises on "The Higher Agriculture," and the like. Mr. Massey, in his preface, says that the intention when writing his book was to produce a simple work on crop raising, suited to the farmer in any section of the country. His promise he keeps good in a manner to gladden the hearts of all who till the soil, either for pleasure or for profit.

INDEX OF INVENTIONS

For which Letters Patent of the United States were Issued for the Week Ending April 7, 1908.

AND EACH BEARING THAT DATE

[See note at end of list about copies of these patents.]

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Acid apparatus for beer casks and the like, carbonic, B. Hadank..... 884,017
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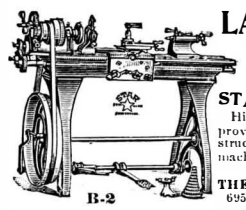
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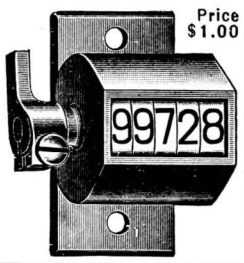

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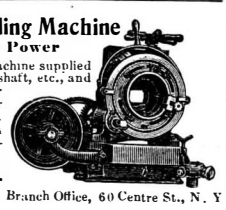

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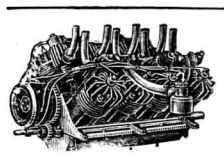

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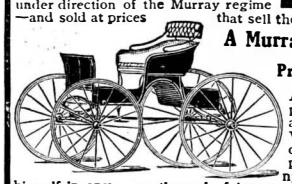

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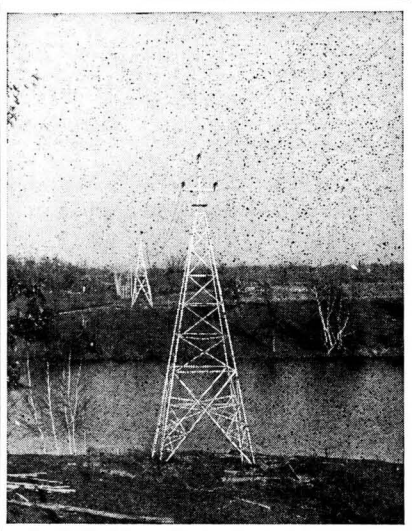
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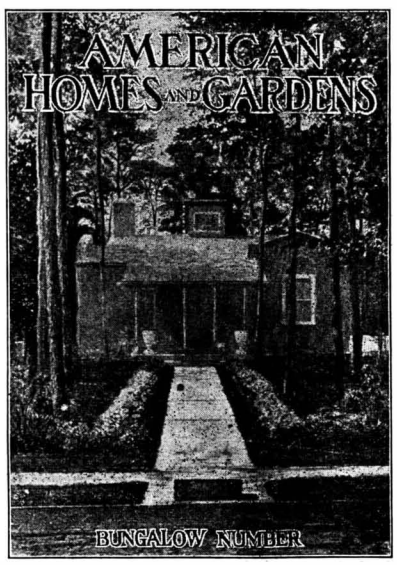

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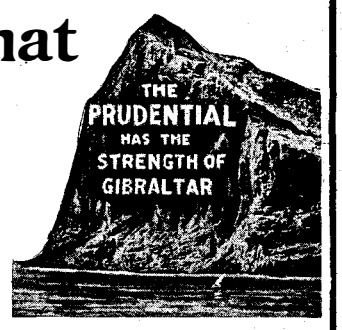

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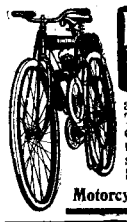

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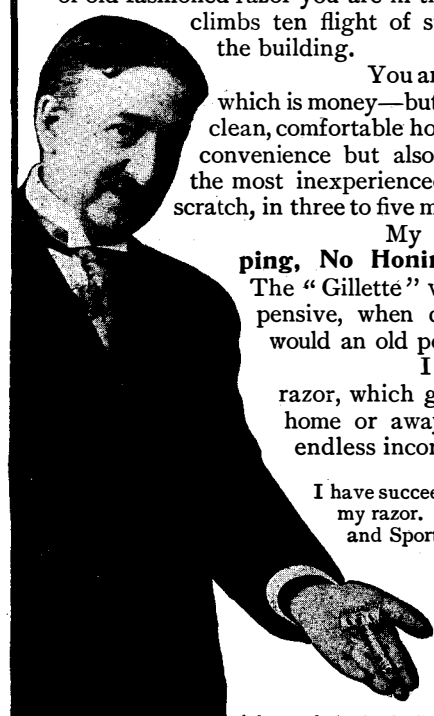

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Inquiry No. 8599.—Wanted to buy a 12-inch copper cylinder head.

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Inquiry No. 8607.—Wanted to buy an electric incubator.

Inquiry No. 8608.—Wanted to buy Broom machinery, Broom corn, Broom handles.

Inquiry No. 8609.—Wanted to buy an automatic coin controlled machine for vending root beer, etc.

Inquiry No. 8610.—Wanted addresses of manufacturers of collapsible tube machinery.

Surfacing machine head, J. F. Stoll	883,920
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Suspender connector, adjustable, A. T. Moore	883,899
Swaging seamless crowns, press for, W. G. Bridge	884,311
Switch. See Electric time switch.	
Switch point lock, G. B. Blevins	884,006
Switch stand, W. W. Scott	883,980
Switching device, Duffy & Irwin	883,701
Table pad, F. A. Brunke	884,067
Tank heater, H. Staadt	884,232
Telegraphy, space, S. Cabot	884,070, 884,071
Telegraphy, space, E. R. Cram	884,076
Telegraphy, space, J. S. Stone	884,106 to 884,109
Telegraphy, space, Stone & Cabot	884,110
Telephone receiver, L. Steinberger	884,235
Telephone support, O. Kraus	883,811
Thread guide, I. E. Palmer	884,037
Tie and rail fastening, combined, R. T. Cummings	884,132
Time indicating device, electric, W. F. Wentz	883,992
Tinning machine, device for feeding, P. Boston	884,008
Tire sealing device, G. H. Phillips	884,294
Tire, vehicle wheel, J. E. Tourtellotte	883,703
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Tobacco pipe cleaner, A. B. Wallen	884,057
Tombstone, E. T. Morris	883,733
Tool box, J. Swan	883,906
Tool, combination, J. E. Sparks	884,229
Tool handle, adjustable, Cunningham & Henley	884,133
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Toy, A. Craven	883,860
Toy, F. Beaumont, Jr	884,259
Toy gun, E. F. Slear	883,915
Track gage, L. Barceloux	883,6
Traction engine, F. I. Cass	883,934
Transom regulating and securing mechanism, H. Bradley	884,261
Transplanting machine, C. E. & H. N. Dyer	884,139
Transporting appliance and the like, J. R. Temperley, et al	883,841
Trap door, W. ●. McCain	884,192
Trick pipe, F. I. Judson	883,717
Trolley pole clamp attachment, Clark & Yingling	884,074
Truck, car, T. H. Curtis	883
Truck, yard, H. Paulson	883,904
Tubes, machine for manufacturing mount, J. E. Graybill	883,875
Tug, chin, W. E. Knapp	883,963
Turbine, W. A. Loudon	883,966
Turbine, C. W. Wellman	884,058
Turbine bucket, W. Kieser	883,889
Turbine bucket fastening, Alexander & Johnson	883,926
Turbine, elastic fluid, M. M. Pearson	883,905
Turbine, elastic fluid, J. G. Callan	883,932
Turbine engine, reversible, H. Pierce	883,910
Turbine nozzle, W. Kieser	883,892
Turbine wheel and bucket, W. Kieser, 883,890,	883,891
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Typewriter carriage shifting mechanism, C. W. Sponsel	883,753
Typewriter machines, time controlled coin operated locking device for, H. Bates	883,854
Typewriting machine, E. B. Hess	884,155
Typewriting machine, C. E. Yetman	884,347
Typewriting machine platen, E. C. Phillips	883,909
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Vehicle, motor, A. Winton	884,117
Vehicle standard, F. W. Bleckley	883,689
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Vehicle wheel, O. M. Fraley	883,947
Vehicles, mud wing for motor, G. Frentzen	883,710
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Vending apparatus, coin-controlled cigar, W. B. Sullivan	884,237
Vending machine, J. G. Huffman	883,886
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Violins and violas, chin rest for, C. F. Steckelberg	883,755
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Wagon hound, G. W. Sirrine	884,225
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Wrench, C. O. Everhart	883,704
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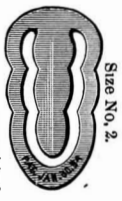

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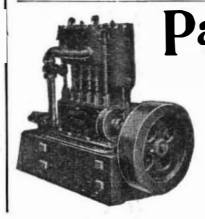

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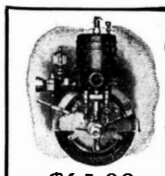

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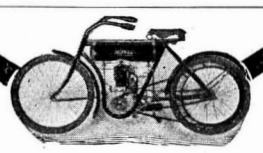

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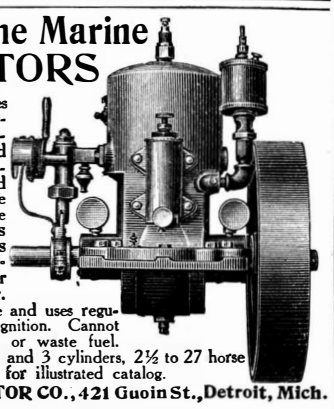

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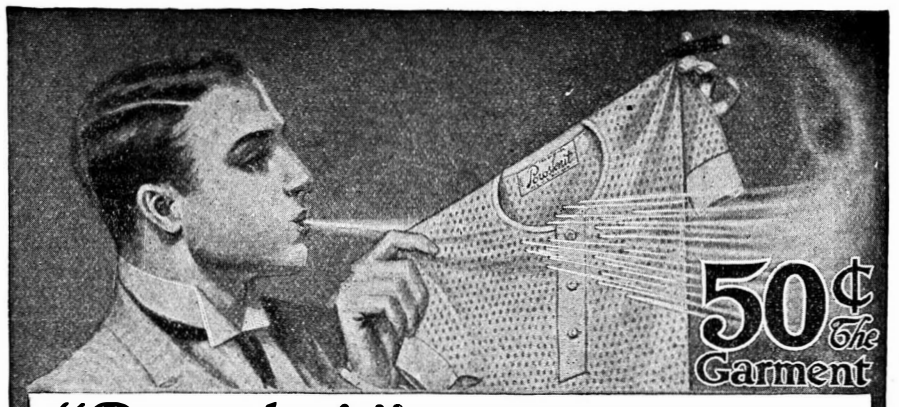

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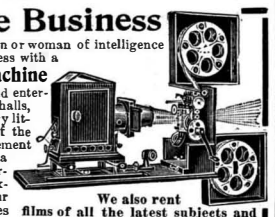

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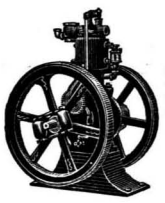

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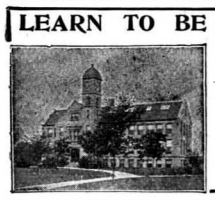

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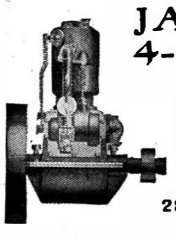

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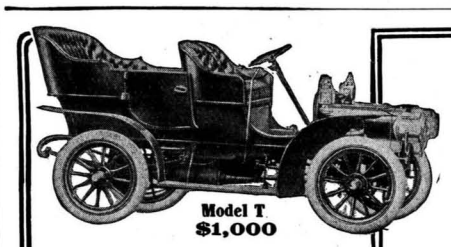

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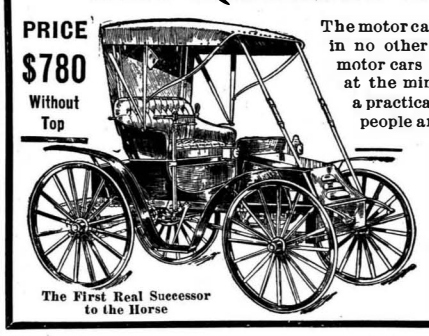

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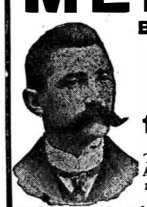

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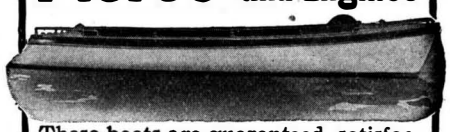

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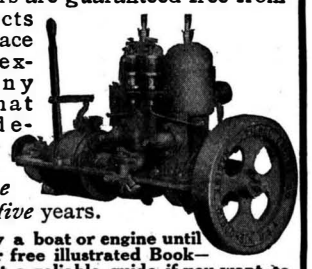

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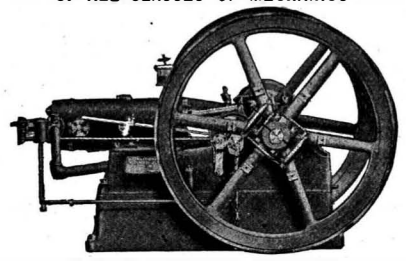

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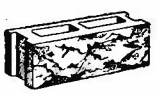

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